PRECISION FM TRANSMITTER

Demonstrate receiver or tuner performance with controlled listening tests

Includes 25μs for Dolby FM

DESCRIPTION

The 1100A Signal Conditioner and the 1000A FM Alignment Generator combine to form a miniature precision fm transmitter. This system converts program material from a phonograph or tape recorder into an extremely high quality fm stereo signal anywhere in the broadcast band. With the 1100A/1000A system you can easily and effectively demonstrate fm receiver performance with listening tests.

INCREASE YOUR DOLLAR VOLUME IN RECEIVER SALES

Sell your customer up to a better receiver by letting him make comparative listening tests using music you select. Let him hear the difference and he will buy the better receiver. With the 1100A/1000A system, you can control your music source. You are no longer at the mercy of fm stations, their program material, multipath, nearby traffic problems, weak signals, competitor's commercials, limited 4-channel material, etc.

USE 2-CHANNEL OR 4-CHANNEL PROGRAM MATERIAL

You needn't depend on local stations for program material. In addition to conventional stereo, you can transmit matrixed 4-channel material directly from a phonograph. Or connect your tape recorder through a matrix encoder to the Model 1100A to transmit discrete 4-channel tapes.

SOUND TECHNOLOGY

1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008
(408) 378-6540

How to demonstrate receiver performance

The tests below are easy to perform with the 1100A/1000A system, and they are easy to explain to your customer, but they dramatically show up deficiencies in receiver performance.

Distortion: Play the program source through the 1100A/1000A system, then play it directly through the receiver's amplifiers, bypassing the fm section. If the receiver is top quality, you will hear no difference in sound. Distortion contributed by the 1100A/1000A system is insignificant – less than 0.1%.

Tuning Characteristics: With the receiver in stereo and a strong signal from the 1100A/1000A transmitter, tune the receiver for optimum indication on its meters. Is the receiver distortion free? Can you tune the receiver slightly to either side without hearing distortion? If not, the receiver bandwidth is too narrow, and it will have to be tuned by ear and continually readjusted as it drifts, an inconvenience at best.

Overmodulation: The FCC allows significant overmodulation, and some receivers can't handle it. Purposely overmodulate the 1100A/1000A system using the meter to tell where you are. Receivers with inadequate bandwidth will break up on loud, high notes. These last two tests are good ways to sell up. Expensive receivers usually have more non-distorting bandwidth and will stand out in these tests.

Sensitivity: Put the receiver in stereo and decrease the 1000A RF LEVEL until the receiver starts to sound noisy and distorted. Be sure the receiver is in stereo, because an insensitive receiver can sound good in mono but not in stereo. This test is much more revealing than an IHF sensitivity check.

Sensitivity to Pilot Level: If the pilot detection circuitry in a receiver is inadequate, the sensitivity test above will reveal the deficiency. Turning the PILOT LEVEL control on the 1000A will help tell if this is the problem when a receiver sounds bad. The FCC permits as little as 8% pilot, and good receivers should get stereo at much lower pilot levels. If a receiver requires a high pilot level, it will work in stereo only on very strong stations and separation and distortion will depend on signal strength.

Separation: Turn the STEREO BALANCE control on the 1100A to either extreme position to transmit only one channel of the music. Evaluate receiver separation with listening tests.

Make a profit on receiver service

The 1000A is a proven profit maker in service. It speeds up receiver alignment and troubleshooting by a factor of 3 to 5. It has shown that it can pay for itself on only one service job a day.

Use the 1100A/1000A system to show a customer how his receiver sounds after servicing. It will help convince him you've given him the best service he can get.

Model 1100A/1000A system specifications

FM RF OUTPUT

TUNING RANGE: 88 to 108 MHz. 6:1 planetary drive provides better than 10 KHz tuning resolution.

DRIFT: No adjustment required after station frequency is set following ½ hour warmup.

TOTAL HARMONIC DISTORTION: Less than 0.1% THD at 1 KHz, 100% modulation.

RESIDUAL FM: Less than 75 Hz, 20 Hz to 15 KHz.

RESIDUAL 38 KHz SUBCARRIER: Less than 0.5%.

OUTPUT LEVEL: 0.5 to 30,000 μv into 50 Ω load, continuously adjustable.

OUTPUT IMPEDANCE: 50 Ω, VSWR less than 1.3, 200 Vdc isolation.

STEREO SEPARATION: Greater than 50 dB at 1 KHz.

METERING

MODULATION LEVEL: 0 to 150%, peak reading.

PILOT: 0 to 15%.

ACCURACY: ±7% of reading ±2% of full scale, 88 to 108 MHz, for audio frequencies 20 Hz to 15 KHz.

AUDIO INPUTS

FREQUENCY RESPONSE (TAPE INPUT, PRE-EMPH IN): Pre-emphasis standard ±0.5 dB, 20 Hz to 15 KHz.

FREQUENCY RESPONSE (PHONO INPUT, PRE-EMPH IN): RIAA standard combined with pre-emphasis standard ±0.5 dB, 20 Hz to 15 KHz.

INPUT IMPEDANCE: 50 KΩ, PHONO or TAPE.

INPUT LEVEL FOR 100% MODULATION: 7 to 15 mVac at 1 KHz on PHONO, 0.2 to 0.5 Vac at 1 KHz on TAPE.

OPTIONS

MODEL 1000A: All Model 1000A options apply.

GENERAL

MODEL 1000A DIMENSIONS: 8-3/8 inches high x 11-1/8 inches wide x 11-3/4 inches deep.

MODEL 1100A DIMENSIONS: 8-3/8 inches high x 5-1/2 inches wide x 11-3/4 inches deep.

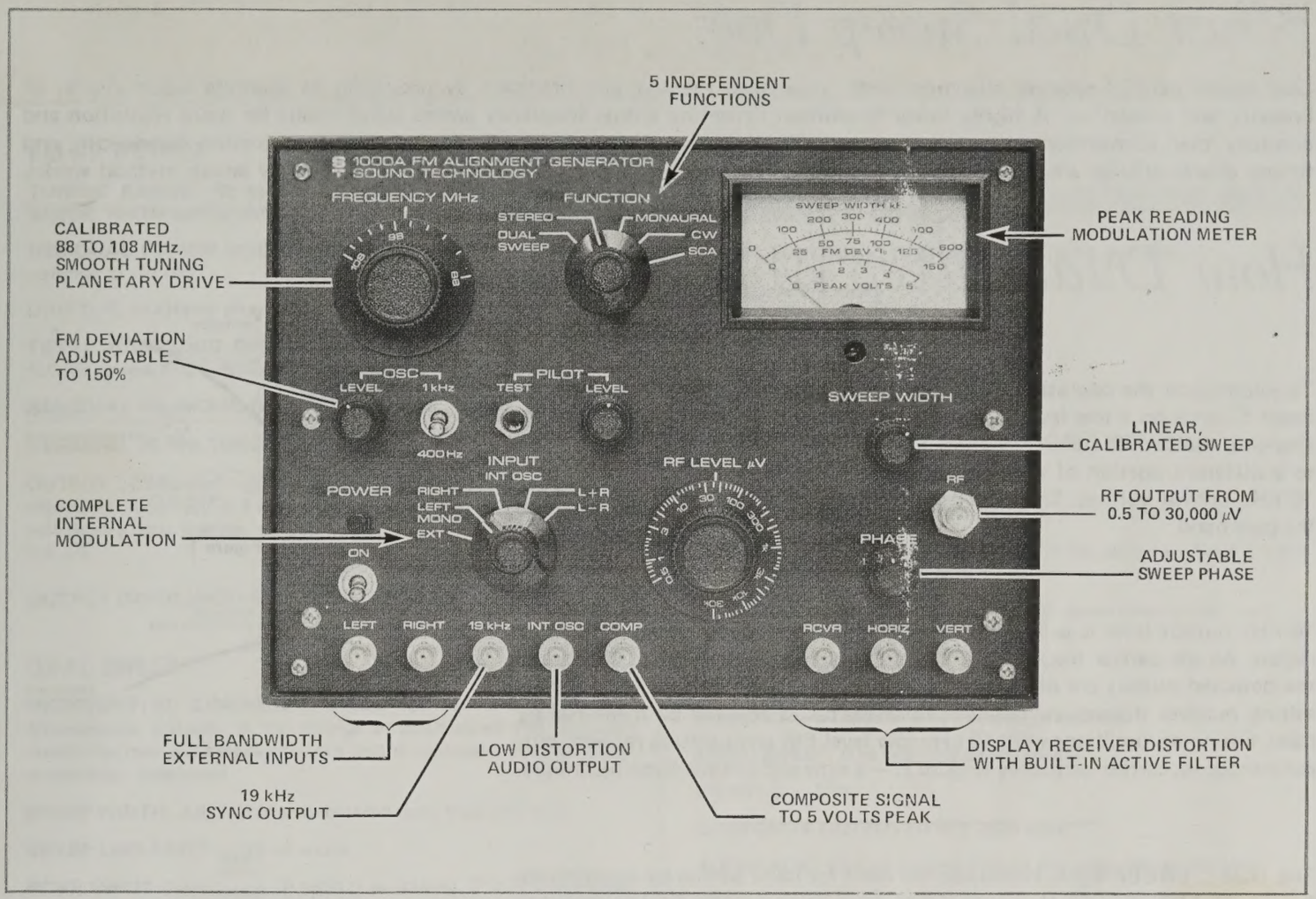
POWER: 115 or 220 V ±10%, 50 to 60 Hz. Model 1000A, 12.5 w, Model 1100A, 6.5 w.

WEIGHT: Model 1000A – 12 lbs. Model 1100A – 6 lbs.

SHIPPING WEIGHT: Model 1000A – 18 lbs. Model 1100A – 10 lbs.

All prices f.o.b. Campbell, California – data subject to change without notice.

Printed in U.S.A. 8/74



Features

- ★ Unique DUAL SWEEP function with a wide-band linear modulator and a built-in active filter lets you see at a glance the critical parameters, LINEARITY, BANDWIDTH, and TUNING SYMMETRY – without probing inside the receiver.
- ★ Conventional sweep alignment capability.
- ★ Linear, calibrated sweep permits direct determination of receiver bandwidth and tuning symmetry.
- ★ RF tuneable from 88 to 108 MHz. Modulation sensitivity held constant across the band.
- ★ Piston attenuator calibrated from 0.5 to 30,000 μV permits a quick look at receiver alignment vs RF level.
- ★ Precision stereo modulator utilizes crystal controlled digital circuits for precise phase relationships. Overall separation better than 50 dB at 1 kHz.
- ★ Low distortion MONAURAL function for over-all receiver distortion measurements.
- ★ CW function provides a signal with very low incidental FM for receiver quieting (signal-to-noise ratio) tests.
- ★ Internal SCA modulation for receiver SCA trap adjustments.
- ★ Sweep width, monaural and stereo modulation, pilot level (X10 scale on PILOT TEST), and composite output monitored on peak reading meter.
- ★ Metered COMPOSITE output for separate alignment and testing of stereo decoders.
- ★ Optional wideband modulation input.
- ★ Optional front panel switch selects 400 Hz or 1 kHz as internal oscillator frequency.

Applications

- ★ Development of stereo FM systems.
- ★ Rapid, accurate production alignment of stereo equipment.
- ★ Servicing FM tuners, receivers, and stereo adapters.
- ★ Fast determination of receiver performance without internal connections.
- ★ Manufacturer's final QA of receivers.
- ★ Development of SCA equipment.

What Dual Sweep Does

Dual sweep permits receiver alignment with unexcelled rapidity and precision by providing an accurate scope display of linearity and distortion. A highly linear modulator driven by a dual frequency sweep signal yields far more resolution and accuracy than conventional sweep techniques. All the signals required for a display of receiver distortion, bandwidth, and tuning characteristics are provided by the 1000A. The text below describes how the dual frequency sweep method works.

How Dual Sweep Works

To understand the operation of DUAL SWEEP, consider the effect of a non-linear S-curve on a low level 10 kHz modulating signal. As shown in Figure 1, changing the carrier frequency from F1 to F2 shifts the demodulation region to a different portion of the S-curve and results in a change in the detected 10 kHz output voltage. The ideal S-curve would have a constant amplitude in the pass band.

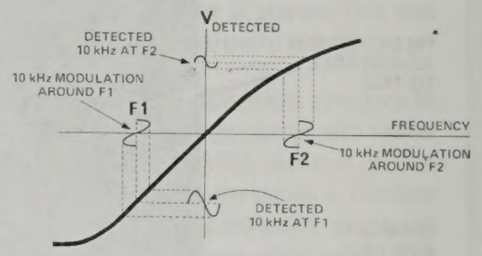


Figure 1.

10 kHz output level is actually a measure of S-curve slope over a very small region. As the carrier frequency is shifted over the receiver band, changes in the detected output are directly proportional to S-curve non-linearity and resulting receiver distortion. Receiver linearity could actually be measured by hand tuning an oscillator with 10 kHz low level FM and plotting receiver output voltage vs. carrier frequency (Figure 2) – a slow and cumbersome technique.

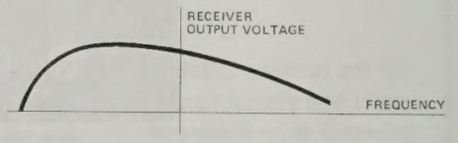


Figure 2.

The DUAL SWEEP signal eliminates the need for hand tuning by superimposing the 10 kHz on a 60 Hz sweep signal, permitting a scope display. Receiver output will be a 60 Hz waveform with 10 kHz superimposed on it. In order to determine the 10 kHz amplitude (our measure of linearity and thus distortion), the 60 Hz must be filtered out. The 1000A has a built-in filter to provide a clean 10 kHz signal. By using the 60 Hz modulation signal for horizontal deflection of a scope and the filtered detector output for vertical deflection, receiver linearity will be displayed as in Figure 3.

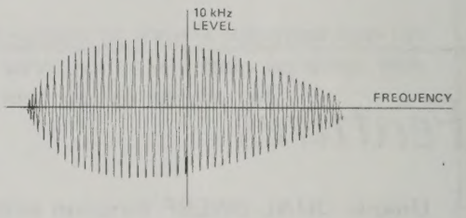


Figure 3.

Advantages of Dual Sweep

Because DUAL SWEEP measures the slope of the S-curve, it provides a display of receiver distortion which is far more sensitive than that obtained by conventional sweep methods. DUAL SWEEP has all the advantages of minimum distortion alignment (it is a direct measure of IM distortion) and yet retains the benefits of conventional sweep alignment. We all know that sweep alignment is highly desireable, not only because of the rapidity and ease of adjustment that goes with a scope display, but because of the information contained in the pattern we see. A conventional sweep display provides immediate information on the effect of receiver adjustments on tuning symmetry and bandwidth, but is not a sensitive measure of distortion. Alignment with a distortion analyzer can yield low distortion but may result in critical tuning characteristics. DUAL SWEEP combines the advantages of both techniques – and eliminates the disadvantages of each.

Not only can a receiver's distortion be measured over its full bandwidth using DUAL SWEEP, but the character of the distortion is displayed on the scope. Figure 4 shows a scope display of the DUAL SWEEP pattern for a receiver with even-order distortion.

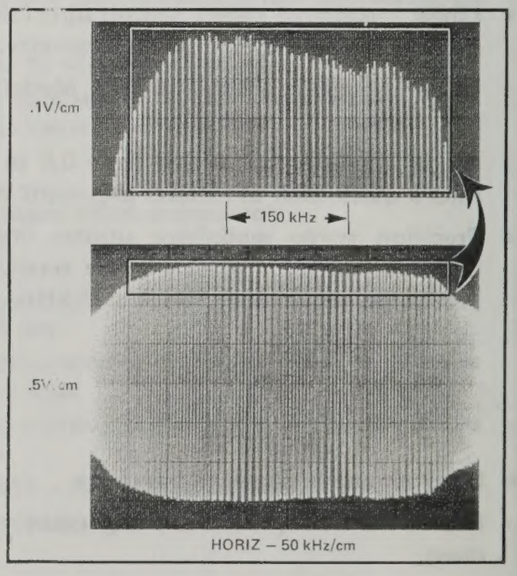


Figure 4. DUAL SWEEP pattern for 0.7% THD.

Specifications

FM RF OUTPUT

TUNING RANGE: 88 to 108 MHz. 6:1 planetary drive provides approx. 10 kHz tuning resolution.

RESIDUAL FM (CW MODE): $<$25 Hz, 20 Hz to 15 kHz (measures quieting to -70 dB).

DRIFT: $<$10 kHz/hr after 1 hour warm-up.

TOTAL HARMONIC DISTORTION: $<$0.1% at 1 kHz monaural, $<$0.2% stereo, 100% modulation.

RESIDUAL FM (MONO OR STEREO): $<$75 Hz, 20 Hz to 15 kHz.

RESIDUAL 38 kHz SUBCARRIER: $<$0.5%, applies to stereo only.

OUTPUT LEVEL: 0.5 to 30,000 μV into 50 ohm load, continuously adjustable. Accuracy is $\pm$1 dB at 98 MHz. Sealed RF unit provides sufficiently low leakage to permit accurate measurements below 0.5 μV.

OUTPUT IMPEDANCE: 50Ω, VSWR $<$1.3, 200 Vdc isolation.

DUAL SWEEP

INCREMENTAL LINEARITY: $\pm$0.3% for 150 kHz bandwidth. (Incremental linearity is the change in small signal FM deviation sensitivity over a stated bandwidth and is equivalent to peak intermodulation distortion).

SWEEP WIDTH: Adjustable and metered from 0 to 600 kHz.

SWEEP LINEARITY: $\pm$3% of width.

RCVR INPUT: Impedance: $>$100KΩ at 10 kHz, $>$10MΩ at 60 Hz. Maximum input is 25 volts peak.

VERT OUTPUT: Impedance 10KΩ. RCVR input-to-VERT output gain $\approx$ 30 at 10 kHz. 10 kHz modulation in DUAL SWEEP $\approx$ 10%.

HORIZ OUTPUT: Impedance 20KΩ. Level $\approx$ 20 volts peak-to-peak.

SWEEP PHASE: Adjustable over 60° range at 60 Hz.

STEREO

SEPARATION: $>$50 dB at 1kHz. Specification includes mono/stereo subchannel separation and pilot phase accuracy and is applicable to composite or RF outputs.

PILOT: 19 kHz $\pm$2 Hz, adjustable from 0 to 20%. PILOT TEST pushbutton removes external LEFT and RIGHT or INT OSC modulation and expands meter scale to 15% full scale.

EXTERNAL LEFT (MONO) AND RIGHT INPUTS

FREQUENCY RESPONSE: $\pm$0.5 dB, 50 Hz to 15 kHz.

INPUT IMPEDANCE: 10KΩ.

LEVEL: $\approx$ 0.4V rms for 100% modulation (no damage at 15 volts peak).

19 kHz OUTPUT

WAVEFORM: 19 kHz $\pm$2 Hz squarewave, $\approx$5 volts peak-to-peak.

OUTPUT IMPEDANCE: 3.3KΩ.

INT OSC OUTPUT

FREQUENCY: 1 kHz $\pm$10%, 10 kHz with FUNCTION switch on DUAL SWEEP, 67 kHz on SCA.

TOTAL HARMONIC DISTORTION: $<$0.1% at 1 kHz.

LEVEL: $\approx$ 2 V rms.

OUTPUT IMPEDANCE: 1KΩ.

COMPOSITE OUTPUT

LEVEL: Adjustable and metered from 0 to 5 volts peak.

OUTPUT IMPEDANCE: $<$600Ω.

TOTAL HARMONIC DISTORTION: $<$0.2% at 5 volts peak.

RESIDUAL 38 kHz SUBCARRIER: $>$50 dB down from 5 volts peak. Applicable to stereo only.

RESIDUAL HUM AND NOISE: $>$60 dB down from 5 volts peak.

METERED FUNCTIONS

MONO AND STEREO: 0 to 150% peak reading.

DUAL SWEEP: 0 to 600 kHz sweep width.

PILOT: 0 to 15%.

COMPOSITE OUTPUT: 0 to 5 volts peak.

ACCURACY: $\pm$7% of reading $\pm$2% of full scale, 88 to 108 MHz.

OPTIONS

WIDEBAND AUXILIARY INPUT (Rear Panel BNC): This wideband modulation input may be used for SCA program material, intermodulation distortion tests, or for adding other complex modulation to the conventional stereo signals. Order M1.

INTERNAL OSCILLATOR: With your order you may specify a 400 Hz internal oscillator instead of the standard 1 kHz at no additional charge.

400Hz/1kHz INTERNAL OSCILLATOR: Front panel toggle switch allows choice of 400 Hz or 1 kHz internal oscillator frequency. Permits measurement of receiver distortion at 400 Hz, separation at 1 kHz as specified in IHF standards. Order M2.

BROADCAST QUALITY STEREO MODULATOR: When M3 is included, a more complex stereo filter is installed in the 1000A. This permits a separation specification of 50 dB from 50 Hz to 8 kHz decreasing to 40 dB at 15 kHz. Essential for receiver design and for receiver testing and evaluation at high audio frequencies. Order M3.

GENERAL

DIMENSIONS: 8-3/8" high x 11-1/8" wide x 11-3/4" deep.

POWER: 115V $\pm$10%, 50 to 60 Hz, 12.5 W.

WEIGHT: 12 lbs.

SHIPPING WEIGHT: 18 lbs.

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Printed in U.S.A. 7/74

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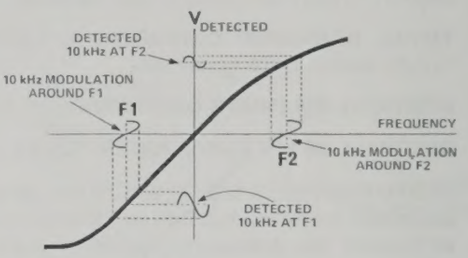

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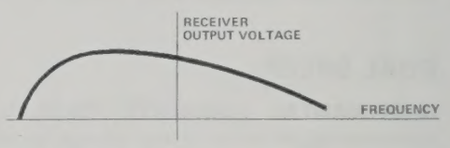

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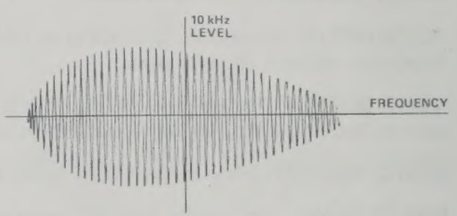

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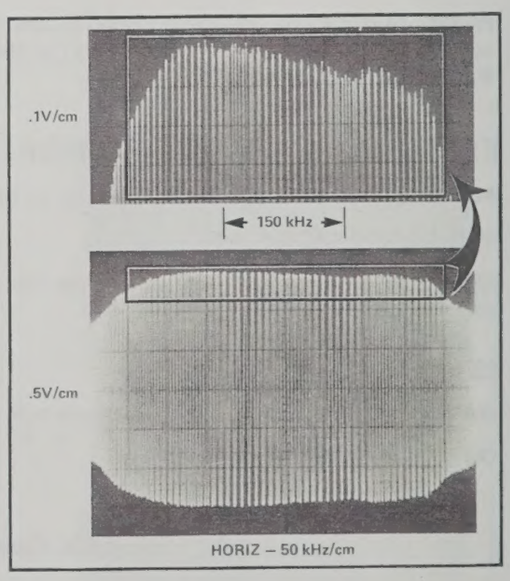

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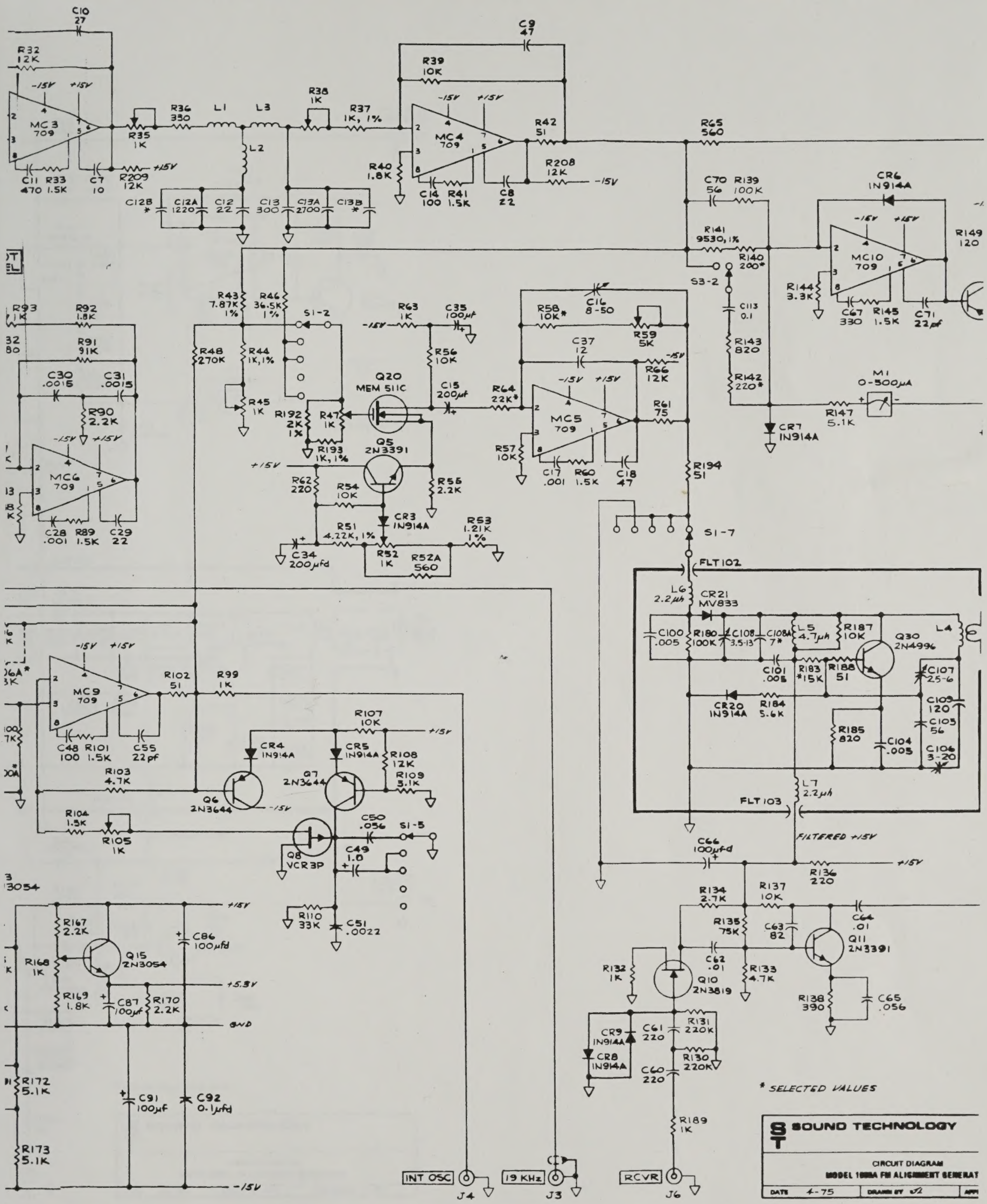
C10 27
R32 12K
MC3 709
R35 1K
R36 330
L1
L3
L2
R38 1K
R37 1K, 1%
C9 47
R39 10K
MC4 709
R42 51
R65 560
R40 1.8K
R208 12K
-15V
+15V
C11 470
R33 1.5K
C7 10
R209 12K
C12B *
C12A 1220
C12 22
C13 300
C13A 2700
C13B *
C14 100
R41 1.5K
C8 22
C70 56
R139 100K
CR6 IN914A
R141 9530, 1%
R140 200*
MC10 709
R149 120
R144 3.3K
C67 330
R145 1.5K
C71 22pf
S3-2
C113 0.1
R143 820
R142 220*
M1 0-500μA
R147 5.1K
CR7 IN914A
R93 1K
R92 1.8K
R91 91K
C30 .0015
C31 .0015
R90 2.2K
MC6 709
C28 .001
R89 1.5K
C29 22
R43 7.87K 1%
R46 36.5K 1%
S1-2
R48 270K
R44 1K, 1%
R45 1K
R63 1K
C35 100μf
R56 10K
Q20 MEM 511C
C15 200μf
R192 2K 1%
R47 1K
R193 1K, 1%
Q5 2N3391
R62 220
R54 10K
R55 2.2K
CR3 IN914A
R51 4.22K, 1%
R52 1K
R52A 560
R53 1.21K 1%
C34 200μfd
R64 22K*
C16 8-50
R58 10K*
R59 5K
C37 12
R66 12K
MC5 709
R61 75
R57 10K
C17 .001
R60 1.5K
C18 47
R194 51
S1-7
FLT102
L6 2.2μh
CR21 MV833
C100 .005
R180 100K
C108 3.5-13
C108A 7*
L5 4.7μh
R187 10K
Q30 2N4996
L4
C101 .005
R183 *15K
R188 51
C107 2.5-6
CR20 IN914A
R184 5.6K
C109 120
C105 56
R185 820
C104 .005
C106 3-20
L7 2.2μh
FLT103
FILTERED +15V
C66 100μfd
R136 220
R134 2.7K
R137 10K
R135 75K
C63 82
C64 .01
Q11 2N3391
C62 .01
R132 1K
Q10 2N3819
R133 4.7K
R138 390
C65 .056
CR9 IN914A
CR8 IN914A
C61 220
R131 220K
R130 220K
C60 220
R189 1K
MC9 709
R102 51
R99 1K
C48 100
R101 1.5K
C55 22pf
R107 10K
CR4 IN914A
CR5 IN914A
R108 12K
R109 5.1K
Q7 2N3644
Q6 2N3644
R103 4.7K
R104 1.5K
R105 1K
C50 .056
S1-5
Q8 VCR3P
C49 1.0
R110 33K
C51 .0022
R167 2.2K
Q15 2N3054
C86 100μfd
R168 1K
R169 1.8K
C87 100μf
R170 2.2K
+5.3V
GND
R172 5.1K
R173 5.1K
C91 100μf
C92 0.1μfd
INT OSC
J4
19 KHz
J3
RCVR
J6
* SELECTED VALUES
SOUND TECHNOLOGY
CIRCUIT DIAGRAM
MODEL 1000A FM ALIGNMENT GENERAT
DATE 4-75

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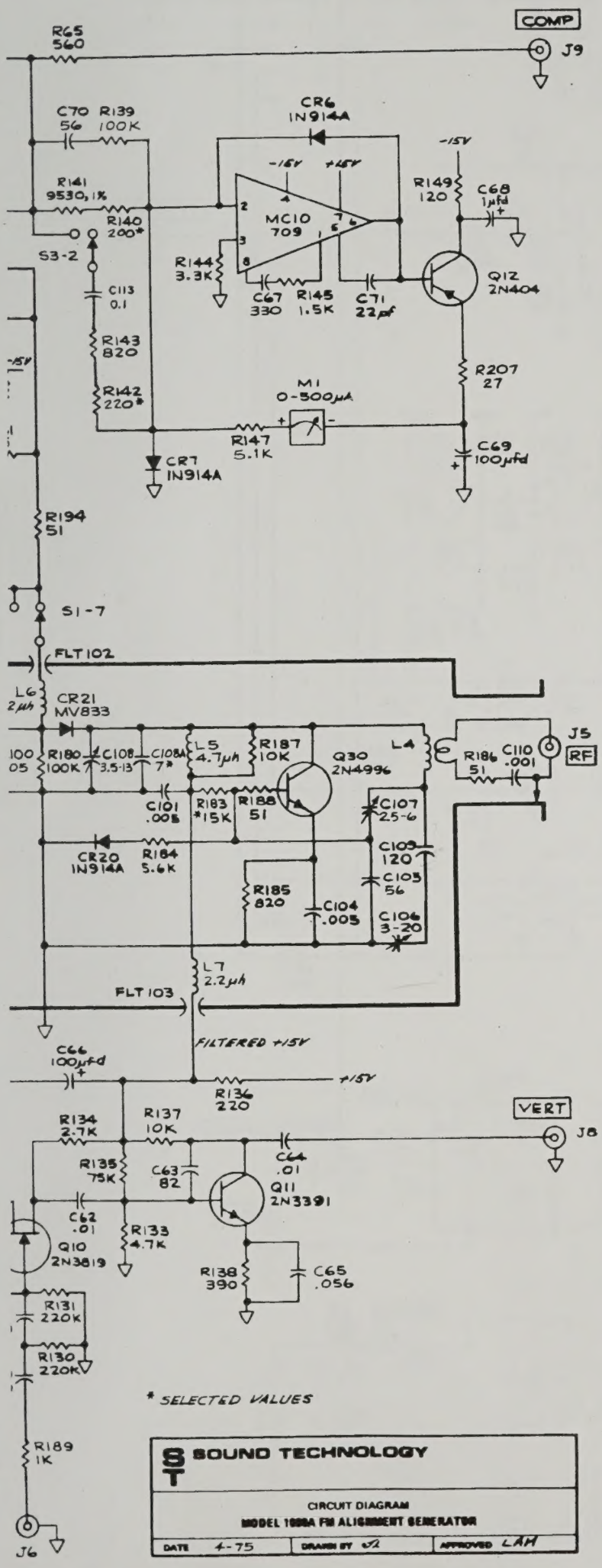

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CIRCUIT DIAGRAM MODEL 1000A FM ALIGNMENT GENERATOR	
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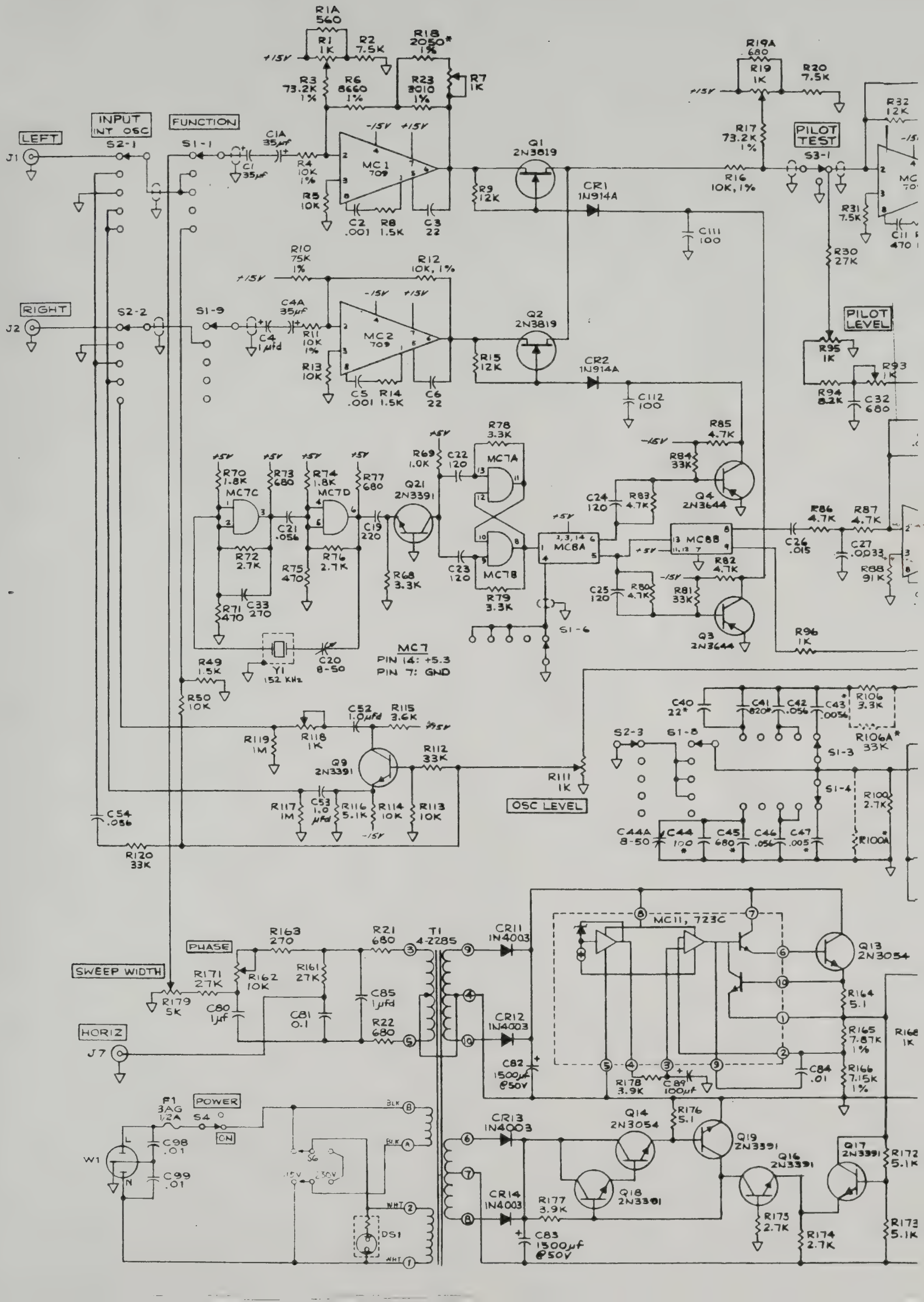
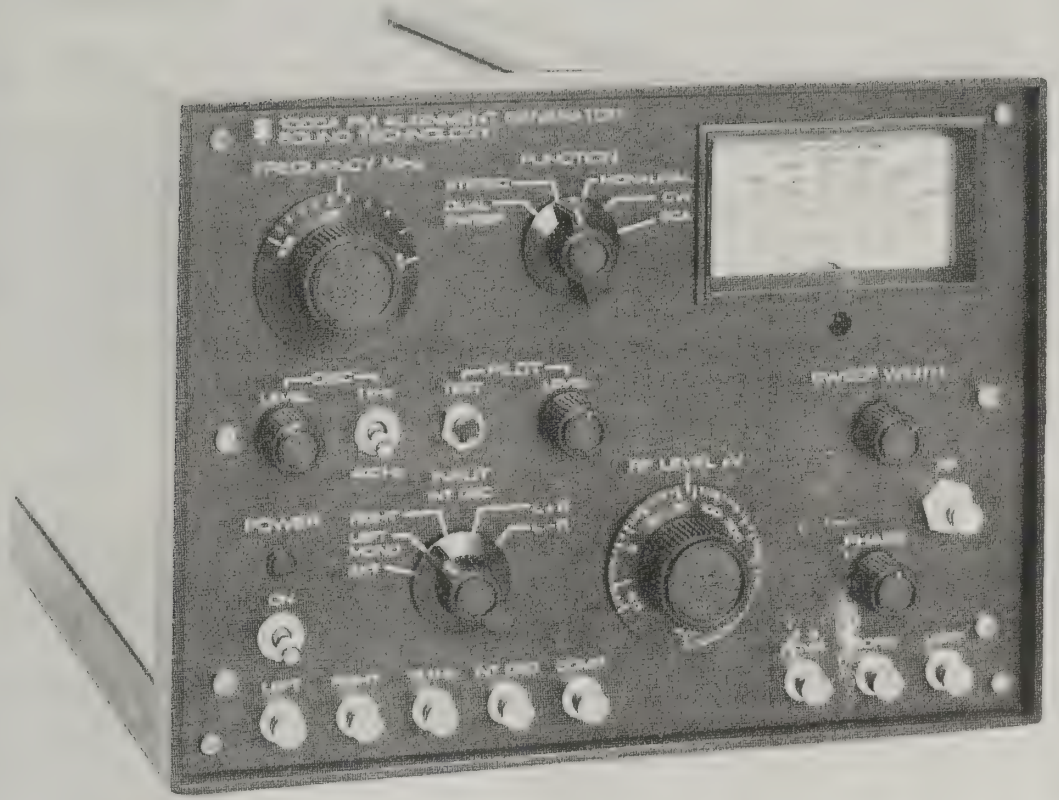

R1A 560
R1 1K
R2 7.5K
R18 2050* 1%
R3 73.2K 1%
R6 8660 1%
R23 3010 1%
R7 1K
+15V
-15V
INPUT INT OSC
FUNCTION
LEFT
J1
S2-1
S1-1
C1A 35µf
C1 35µf
R4 10K 1%
R5 10K
MC1 709
C2 .001
R8 1.5K
C3 22
Q1 2N3819
R9 12K
CR1 1N914A
C111 100
R19A 680
R19 1K
R20 7.5K
R17 73.2K 1%
R16 10K, 1%
PILOT TEST
S3-1
R32 12K
R31 7.5K
R30 27K
C11 470
R10 75K 1%
R12 10K, 1%
RIGHT
J2
S2-2
S1-9
C4A 35µf
C4 1 µfd
R11 10K 1%
R13 10K
MC2 709
C5 .001
R14 1.5K
C6 22
Q2 2N3819
R15 12K
CR2 1N914A
C112 100
PILOT LEVEL
R95 1K
R93 1K
R94 8.2K
C32 680
R78 3.3K
R69 1.0K
C22 120
MC7A
MC7B
MC7C
MC7D
R70 1.8K
R73 680
R74 1.8K
R77 680
C21 .056
C19 220
Q21 2N3391
R72 2.7K
R75 470
R76 2.7K
R68 3.3K
C23 120
R71 470
C33 270
Y1 152 KHz
C20 8-50
R49 1.5K
R50 10K
MC7 PIN 14: +5.3 PIN 7: GND
R85 4.7K
R84 33K
Q4 2N3644
C24 120
R83 4.7K
MC8A
MC8B
R86 4.7K
R87 4.7K
C26 .015
C27 .0033
R88 91K
R82 4.7K
C25 120
R80 4.7K
R81 33K
Q3 2N3644
R96 1K
S1-6
C54 .056
R120 33K
C52 1.0µfd
R115 3.6K
R119 1M
R118 1K
Q9 2N3391
R112 33K
R111 1K
OSC LEVEL
R117 1M
C53 1.0 µfd
R116 5.1K
R114 10K
R113 10K
S2-3
S1-8
S1-3
S1-4
C40 22*
C41 820*
C42 .056
C43 .0056*
R106 3.3K
R106A* 33K
R100 2.7K
R100A*
C44A 8-50
C44 100*
C45 680*
C46 .056
C47 .005*
SWEEP WIDTH
PHASE
R163 270
R171 27K
R162 10K
R161 27K
R179 5K
C80 1µf
C81 0.1
R21 680
C85 1 µfd
R22 680
T1 4-2285
HORIZ
J7
CR11 1N4003
CR12 1N4003
C82 1500µf @50V
MC11, 723C
Q13 2N3054
R164 5.1
R165 7.87K 1%
R166 7.15K 1%
R178 3.9K
C89 100µf
C84 .01
R168 1K
F1 3AG 1/2A
POWER
S4
ON
W1
C98 .01
C99 .01
S6
115V
230V
BLK
WHT
DS1
CR13 IN4003
CR14 IN4003
Q14 2N3054
R176 5.1
Q19 2N3391
Q18 2N3391
Q16 2N3391
Q17 2N3391
R177 3.9K
C83 1500µf @50V
R175 2.7K
R174 2.7K
R172 5.1K
R173 5.1K

MODEL 1000A

FM ALIGNMENT GENERATOR

COMPLETE RECEIVER ALIGNMENT – A MINIATURE LOW DISTORTION FM TRANSMITTER PLUS FAST, ACCURATE DUAL SWEEP ALIGNMENT



1. Dual sweep alignment.
2. Complete stereo generator.
3. Monophonic FM generator.
4. Clean CW signal.
5. SCA modulation.

The all solid-state 1000A FM ALIGNMENT GENERATOR is designed specifically to permit fast, accurate adjustment of monaural and stereo FM systems. DUAL SWEEP, a refinement of conventional sweep alignment techniques, provides a unique visual display of receiver performance. An operator need only connect the 1000A RF output to the receiver antenna terminals and feed the receiver audio output to the 1000A's built-in filter. Distortion and tuning characteristics will then be displayed – even on an inexpensive scope – without probing inside the receiver.

The 1000A offers much more than DUAL SWEEP capability. With a highly linear modulator, it produces complete, high quality, monaural and stereo signals exceeding FCC specs. An internal RF oscillator is tuneable across the fm band and provides an output continuously adjustable in level from 0.5 to 30,000 μv.

1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008
(408) 378-6540

FM RF OUTPUT

TUNING RANGE: 88 to 108 MHz. 6:1 planetary drive provides approx. 10 kHz tuning resolution.

RESIDUAL FM (CW MODE): $<$25 Hz, 20 Hz to 15 kHz (measures quieting to -70 dB).

DRIFT: $<$10 kHz/hr after 1 hour warm-up.

TOTAL HARMONIC DISTORTION: $<$0.1% at 1 kHz monaural, $<$0.2% stereo, 100% modulation.

RESIDUAL FM (MONO OR STEREO): $<$75 Hz, 20 Hz to 15 kHz.

RESIDUAL 38 kHz SUBCARRIER: $<$0.5%, applies to stereo only.

OUTPUT LEVEL: 0.5 to 30,000 μV into 50 ohm load, continuously adjustable. Accuracy is $\pm$1 dB at 98 MHz. Sealed RF unit provides sufficiently low leakage to permit accurate measurements below 0.5 μV.

OUTPUT IMPEDANCE: 50Ω, VSWR $<$1.3, 200 Vdc isolation.

DUAL SWEEP

INCREMENTAL LINEARITY: $\pm$0.3% for 150 kHz bandwidth. (Incremental linearity is the change in small signal FM deviation sensitivity over a stated bandwidth and is equivalent to peak intermodulation distortion).

SWEEP WIDTH: Adjustable and metered from 0 to 600 kHz.

SWEEP LINEARITY: $\pm$3% of width.

RCVR INPUT: Impedance: $>$100KΩ at 10 kHz, $>$10MΩ at 60 Hz. Maximum input is 25 volts peak.

VERT OUTPUT: Impedance 10KΩ. RCVR input-to-VERT output gain $\approx$ 30 at 10 kHz. 10 kHz modulation in DUAL SWEEP $\approx$ 10%.

HORIZ OUTPUT: Impedance 20KΩ. Level $\approx$ 20 volts peak-to-peak.

SWEEP PHASE: Adjustable over 60° range at 60 Hz.

STEREO

SEPARATION: $>$50 dB at 1kHz. Specification includes mono/stereo subchannel separation and pilot phase accuracy and is applicable to composite or RF outputs.

PILOT: 19 kHz $\pm$2 Hz, adjustable from 0 to 20%. PILOT TEST pushbutton removes external LEFT and RIGHT or INT OSC modulation and expands meter scale to 15% full scale.

EXTERNAL LEFT (MONO) AND RIGHT INPUTS

FREQUENCY RESPONSE: $\pm$0.5 dB, 50 Hz to 15 kHz.

INPUT IMPEDANCE: 10KΩ.

LEVEL: $\approx$ 0.4V rms for 100% modulation (no damage at 15 volts peak).

19 kHz OUTPUT

WAVEFORM: 19 kHz $\pm$2 Hz squarewave, $\approx$5 volts peak-to-peak.

OUTPUT IMPEDANCE: 3.3KΩ.

INT OSC OUTPUT

FREQUENCY: 1 kHz $\pm$10%, 10 kHz with FUNCTION switch on DUAL SWEEP, 67 kHz on SCA.

TOTAL HARMONIC DISTORTION: $<$0.1% at 1 kHz.

LEVEL: $\approx$ 2 V rms.

OUTPUT IMPEDANCE: 1KΩ.

COMPOSITE OUTPUT

LEVEL: Adjustable and metered from 0 to 5 volts peak.

OUTPUT IMPEDANCE: $<$600Ω.

TOTAL HARMONIC DISTORTION: $<$0.2% at 5 volts peak.

RESIDUAL 38 kHz SUBCARRIER: $>$50 dB down from 5 volts peak. Applicable to stereo only.

RESIDUAL HUM AND NOISE: $>$60 dB down from 5 volts peak.

METERED FUNCTIONS

MONO AND STEREO: 0 to 150% peak reading.

DUAL SWEEP: 0 to 600 kHz sweep width.

PILOT: 0 to 15%.

COMPOSITE OUTPUT: 0 to 5 volts peak.

ACCURACY: $\pm$7% of reading $\pm$2% of full scale, 88 to 108 MHz.

OPTIONS

WIDEBAND AUXILIARY INPUT (Rear Panel BNC): This wideband modulation input may be used for SCA program material, intermodulation distortion tests, or for adding other complex modulation to the conventional stereo signals. Order M1.

INTERNAL OSCILLATOR: With your order you may specify a 400 Hz internal oscillator instead of the standard 1 kHz at no additional charge.

400Hz/1kHz INTERNAL OSCILLATOR: Front panel toggle switch allows choice of 400 Hz or 1 kHz internal oscillator frequency. Permits measurement of receiver distortion at 400 Hz, separation at 1 kHz as specified in IHF standards. Order M2.

BROADCAST QUALITY STEREO MODULATOR: When M3 is included, a more complex stereo filter is installed in the 1000A. This permits a separation specification of 50 dB from 50 Hz to 8 kHz decreasing to 40 dB at 15 kHz. Essential for receiver design and for receiver testing and evaluation at high audio frequencies. Order M3.

GENERAL

DIMENSIONS: 8-3/8" high x 11-1/8" wide x 11-3/4" deep.

POWER: 115V $\pm$10%, 50 to 60 Hz, 12.5 W.

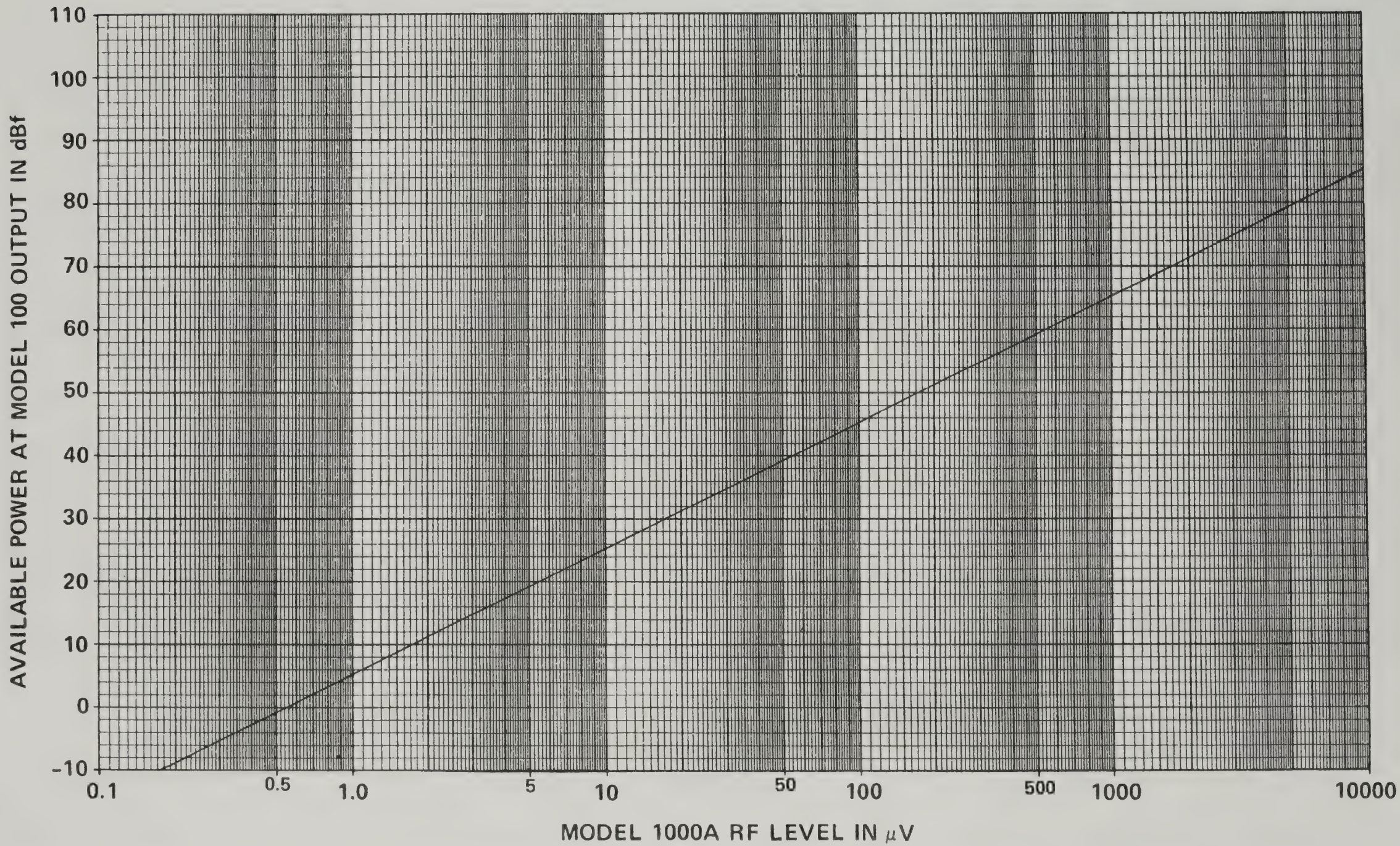
WEIGHT: 12 lbs.

SHIPPING WEIGHT: 18 lbs.

All prices f.o.b. Campbell, California — data subject to change without notice.

Printed in U.S.A. 7/74

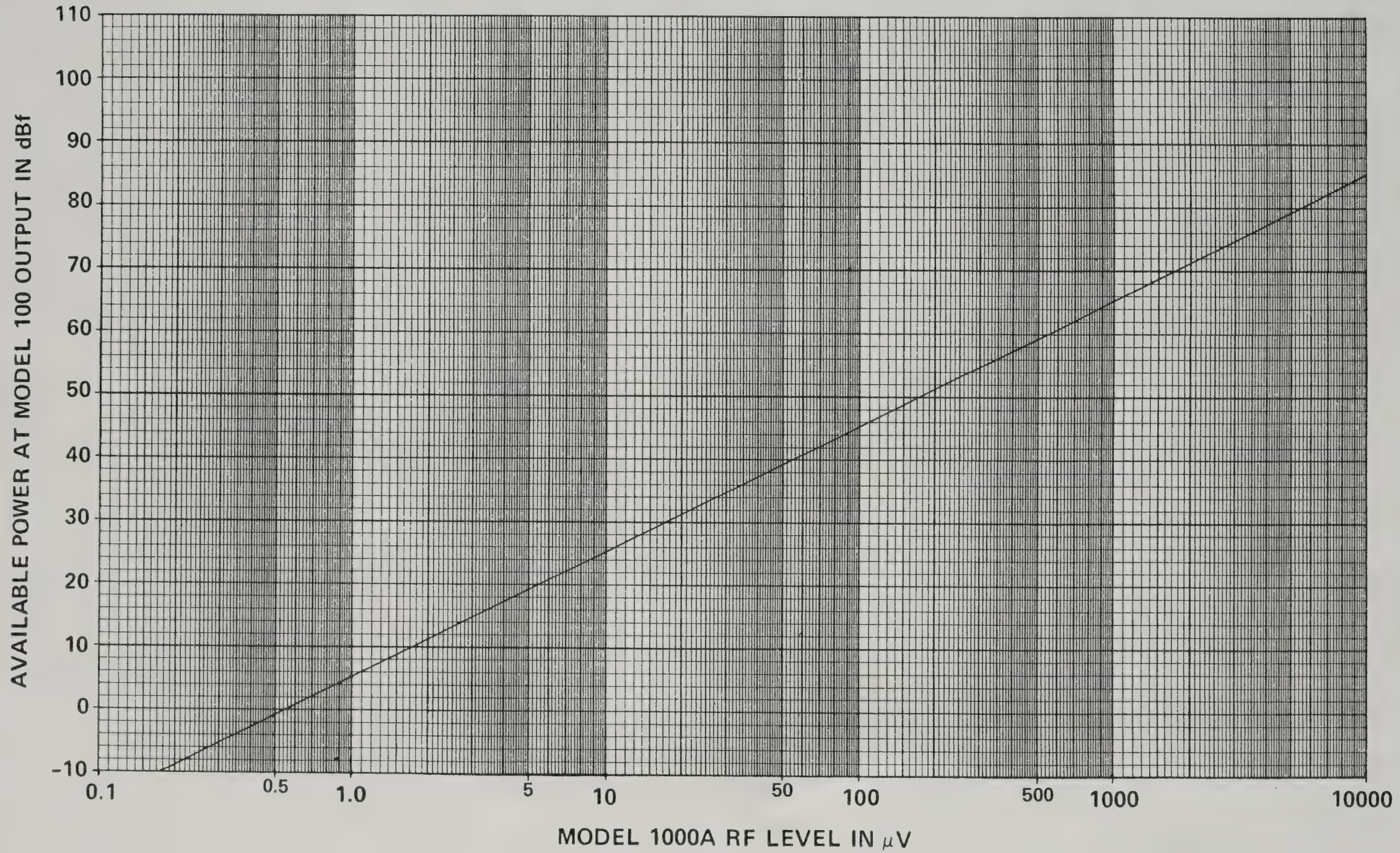
MODEL 1000A FM ALIGNMENT GENERATOR OUTPUT IN μV
VS.
AVAILABLE POWER AT MODEL 100 MATCHING TRANSFORMER OUTPUT IN dBf



SOUND TECHNOLOGY

1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008

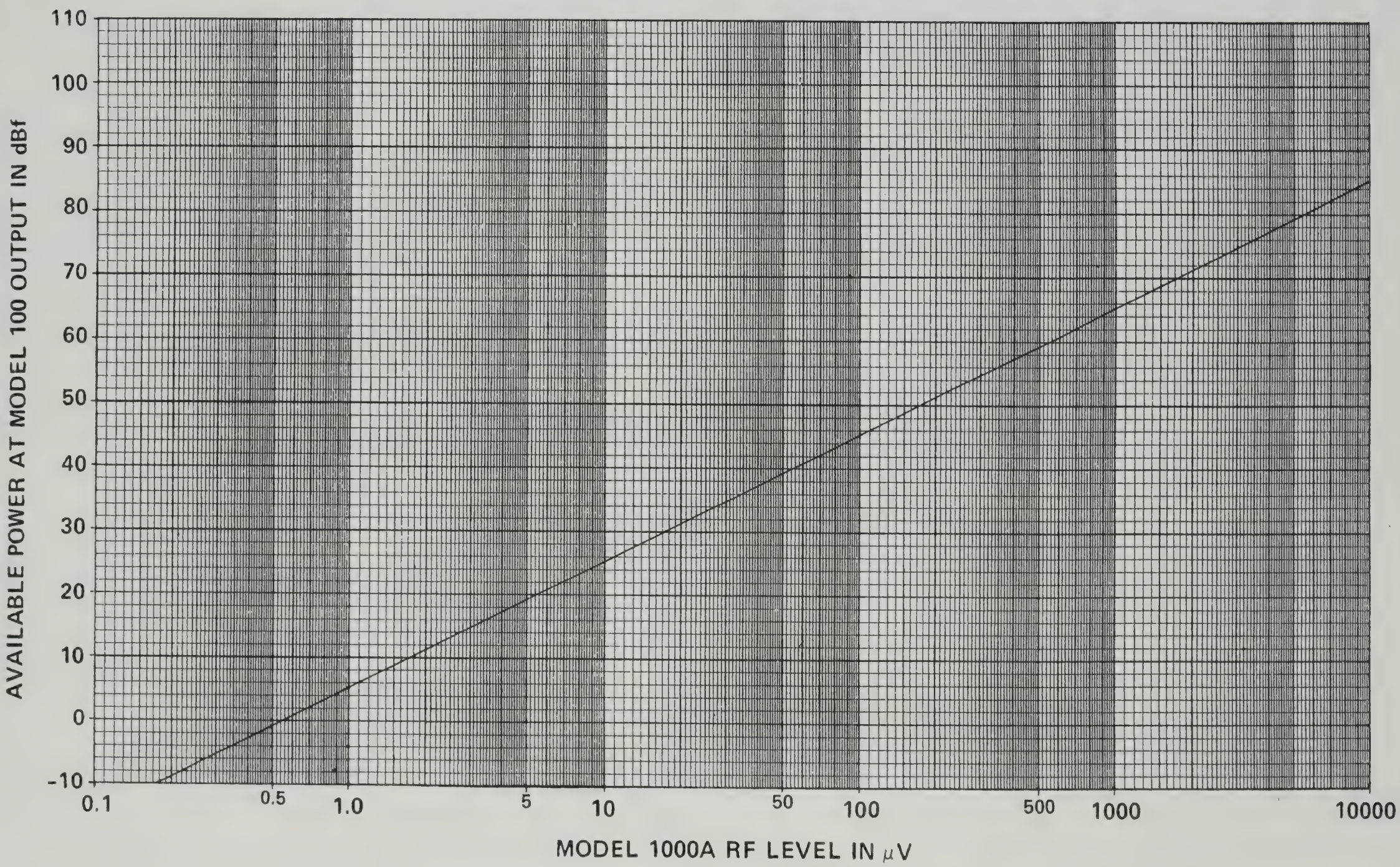
MODEL 1000A FM ALIGNMENT GENERATOR OUTPUT IN μV
VS.
AVAILABLE POWER AT MODEL 100 MATCHING TRANSFORMER OUTPUT IN dBf



SOUND TECHNOLOGY

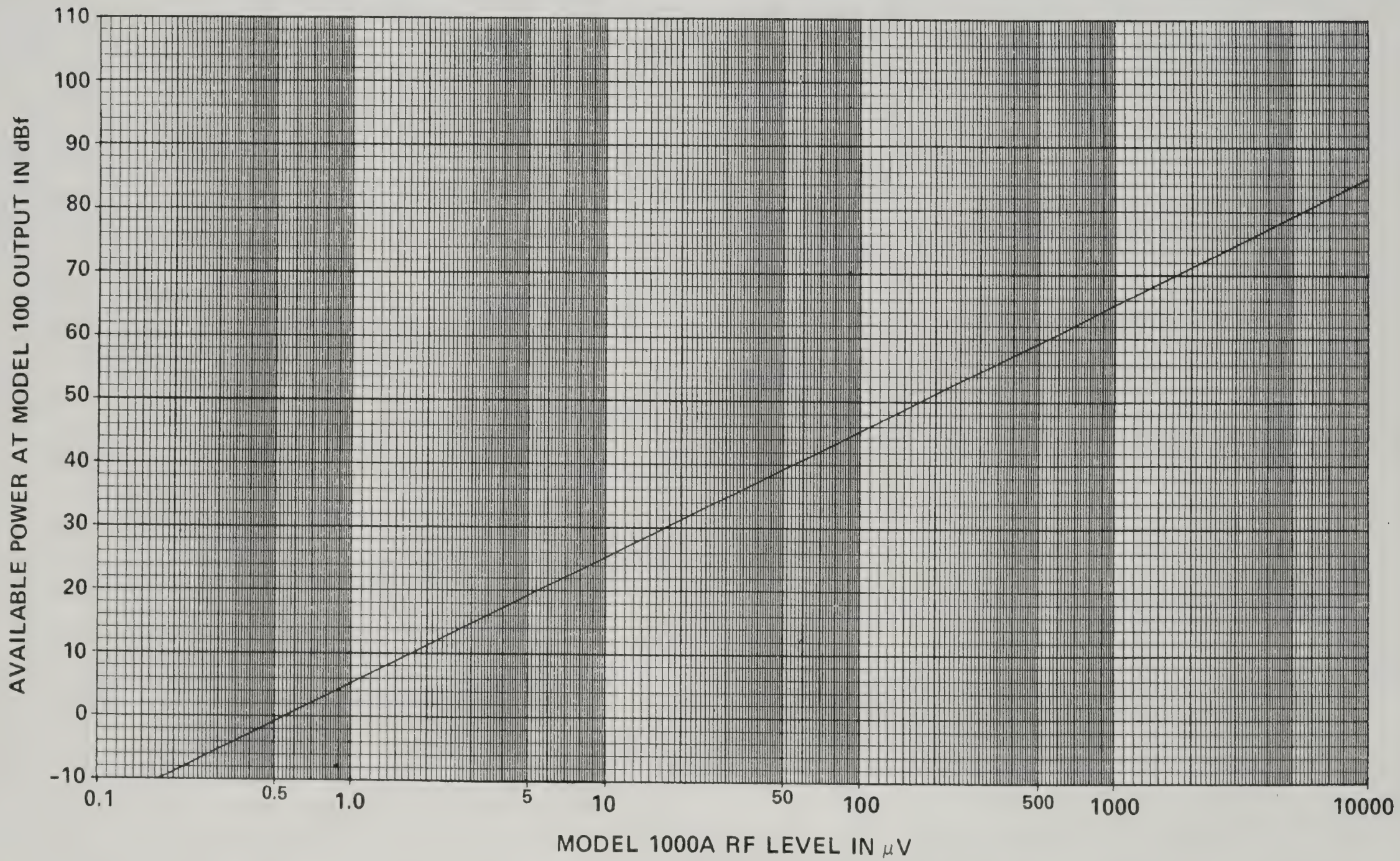
1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008

MODEL 1000A FM ALIGNMENT GENERATOR OUTPUT IN μV
VS.
AVAILABLE POWER AT MODEL 100 MATCHING TRANSFORMER OUTPUT IN dBf



SOUND TECHNOLOGY
1400 DELL AVENUE

MODEL 1000A FM ALIGNMENT GENERATOR OUTPUT IN μV
VS.
AVAILABLE POWER AT MODEL 100 MATCHING TRANSFORMER OUTPUT IN dBf



SOUND TECHNOLOGY
1400 DELL AVENUE

LEFT J1 · INPUT INT OSC S2-1 · FUNCTION S1-1 · C1A 35µf · C1 35µf · R4 10K 1% · R5 10K · MC1 709 · C2 .001 · R8 1.5K · C3 22 · R1A 560 · R1 1K · R2 7.5K · R18 2050* 1% · R23 3010 1% · R7 1K · R3 73.2K 1% · R6 8660 1% · +15V · -15V · R9 12K · Q1 2N3819 · CR1 1N914A · C111 100

RIGHT J2 · S2-2 · S1-9 · C4A 35µf · C4 1µfd · R11 10K 1% · MC2 709 · C5 .001 · R14 1.5K · C6 22 · R13 10K · R10 75K 1% · R12 10K, 1% · R15 12K · Q2 2N3819 · CR2 1N914A · C112 100

R19A 680 · R19 1K · R20 7.5K · R17 73.2K 1% · R16 10K, 1% · PILOT TEST S3-1 · C10 27 · R32 12K · MC3 709 · C11 470 · R33 1.5K · C7 10 · R209 12K · R35 1K · R36 330 · L1 · L3 · L2 · R38 1K · R37 1K, 1% · C9 47 · R39 10K · MC4 709 · C14 100 · R41 1.5K · C8 22 · R42 51 · R208 12K · R31 7.5K · R30 27K · C12A 1220 · C12 2.2 · C13 300 · C13A 2700 · C12B * · C13B * · R65 560 · COMP J9

PILOT LEVEL · R95 1K · R94 8.2K · C32 680 · R93 1K · R92 1.8K · R91 91K · C30 .0015 · C31 .0015 · R90 2.2K · MC6 709 · C27 .0033 · R88 91K · C28 .001 · R89 1.5K · C29 22 · R86 4.7K · R87 4.7K · C26 .015

R78 3.3K · MC7A · MC7B · MC7C · MC7D · R69 1.0K · C22 120 · C23 120 · R79 3.3K · R68 3.3K · Q21 2N3391 · C19 220 · C21 .056 · R72 2.7K · R71 470 · C33 270 · R75 470 · R76 2.7K · R70 1.8K · R73 680 · R74 1.8K · R77 680 · Y1 152 KHz · C20 8-50 · R49 1.5K · R50 10K · C54 .056 · R120 33K · MC7 PIN 14: +5.3 PIN 7: GND

R85 4.7K · R84 33K · Q4 2N3644 · C24 120 · R83 4.7K · MC8A · MC8B · R82 4.7K · C25 120 · R80 4.7K · R81 33K · Q3 2N3644 · S1-6 · R96 1K

C52 1.0µfd · R115 3.6K · R118 1K · R119 1M · Q9 2N3391 · R112 33K · C53 1.0 µfd · R117 1M · R116 5.1K · R114 10K · R113 10K · R111 1K · OSC LEVEL

C40 22* · C41 820* · C42 .056 · C43 .0056 · R106 3.3K · R106A* 33K · S2-3 · S1-8 · S1-3 · S1-4 · R100 2.7K · R100A* · C44A 8-50 · C44 100 * · C45 680 * · C46 .056 · C47 .005 * · MC9 709 · C48 100 · R101 1.5K · C55 22pf · R102 51 · R99 1K · R103 4.7K · R104 1.5K · R105 1K

R107 10K · CR4 1N914A · CR5 1N914A · R108 12K · R109 5.1K · Q7 2N3644 · Q6 2N3644 · Q8 VCR3P · C50 .056 · S1-5 · C49 1.0 · R110 33K · C51 .0022

R43 7.87K 1% · R46 36.5K 1% · S1-2 · R48 270K · R44 1K, 1% · R45 1K · R63 1K · C35 100µf · R56 10K · C15 200µf · R64 22K* · R192 2K 1% · R47 1K · R193 1K, 1% · Q20 MEM 511C · Q5 2N3391 · R62 220 · R54 10K · R55 2.2K · CR3 1N914A · R51 4.22K, 1% · C34 200µfd · R52 1K · R52A 560 · R53 1.21K 1%

R58 10K* · C16 8-50 · R59 5K · C37 12 · R66 12K · MC5 709 · C17 .001 · R60 1.5K · C18 47 · R57 10K · R61 75 · R194 51 · S1-7

C70 56 · R139 100K · R141 9530, 1K · R140 200* · S3-2 · C113 0.1 · R143 820 · R142 220* · CR7 1N914A · CR6 1N914A · MC10 709 · R144 3.3K · C67 330 · R145 1.5K · C71 22pf · R149 120 · C68 1µfd · Q12 2N404 · M1 0-500µA · R147 5.1K · R207 27 · C69 100µfd

FLT102 · L6 2.2µh · CR21 MV833 · C100 .005 · R180 100K · C108 3.5-13* · C102 7* · L5 4.7µh · R187 10K · Q30 2N4996 · L4 · R186 51 · C110 .001 · J5 RF · C101 .005 · R183 *15K · R188 51 · C107 2.5-6 · CR20 1N914A · R184 5.6K · C109 120 · C103 56 · R185 820 · C104 .005 · C106 3-20 · FLT103 · L7 2.2µh · FILTERED +15V · C66 100µfd · R136 220 · VERT J8

R134 2.7K · R135 75K · C63 82 · C64 .01 · Q11 2N3391 · R137 10K · R132 1K · Q10 2N3819 · R133 4.7K · R138 390 · C65 .056 · CR9 1N914A · CR8 1N914A · C61 220 · R131 220K · C60 220 · R130 220K · R189 1K

PHASE · SWEEP WIDTH · R179 5K · C80 1µf · R171 2.7K · R162 10K · R161 27K · C81 0.1 · R163 270 · R21 680 · R22 680 · C85 1µfd · T1 4-2285 · HORIZ J7

CR11 1N4003 · CR12 1N4003 · C82 1500µf @50V · MC11, 723C · Q13 2N3054 · R164 5.1 · R165 7.87K 1% · R166 7.15K 1% · C84 .01 · R178 3.9K · C89 100µf · R167 2.2K · Q15 2N3054 · R168 1K · R169 1.8K · C87 100µf · R170 2.2K · C86 100µfd · +15V · +5.8V · GND · -15V · C91 100µf · C92 0.1µfd

CR13 1N4003 · CR14 1N4003 · C83 1500µf @50V · Q14 2N3054 · R176 5.1 · Q19 2N3391 · Q16 2N3391 · Q17 2N3391 · Q18 2N3391 · R177 3.9K · R175 2.7K · R174 2.7K · R172 5.1K · R173 5.1K

F1 3AG 1.2A · POWER · S4 · ON · W1 · C98 .01 · C99 .01 · DS1 · BLK · WHT · 15V · 30V

INT OSC J4 · 19 KHz J3 · RCVR J6

* SELECTED VALUES

SOUND TECHNOLOGY

CIRCUIT DIAGRAM
MODEL 1600A FM ALIGNMENT GENERATOR

DATE 4-75 · DRAWN BY JV2 · APPROVED LAH

OPERATING INSTRUCTIONS

INTRODUCTION

The 1000A is a frequency-modulated RF generator with modulation and output capabilities which permit complete alignment and testing of stereo or monaural receivers and tuners. DUAL SWEEP, a unique and very sensitive sweep alignment technique, has been incorporated in the 1000A. Although the 1000A may be used for conventional sweep alignment, it is highly recommended that the user learn the DUAL SWEEP method. With a little practice it is much faster and leads to the best possible alignment.

ANTENNA CONNECTION

The RF LEVEL dial reads RF output voltage appearing across a 50Ω load. The load normally consists of a length of 50Ω cable such as RG 58A/U terminated in 50Ω. A matching network is required in order to properly terminate the 50Ω cable and at the same time provide the correct impedance looking back from the antenna terminals of the receiver under test.

The Sound Technology Model 100 Matching Transformer was designed for this purpose. The input to the Model 100 (a BNC connector) presents a 50Ω load to the generator. The output (a detachable 300Ω plug wired with 12" of twin lead terminated in spade lugs) presents a 300Ω source impedance to the receiver under test, thus simulating the 300Ω source impedance of a folded dipole antenna system. Voltage transfer ratio is 1:1 so that the 1000A RF LEVEL dial reads directly the voltage applied to the receiver antenna terminals. Because of its internal electrostatic shielding, it may be used with either a balanced or an unbalanced (one side grounded) receiver antenna input configuration.

If a suitable matching transformer is not available, a resistive network may be used to match the 50Ω unbalanced output of the 1000A to the 300Ω antenna input of the receiver under test. Examples of how to do this with common values of resistors are shown in Fig. 1. In all of these cases the matching network provides 6 dB of attenuation, and it is necessary to divide RF LEVEL dial reading by 2 in order to get the voltage appearing across the antenna terminals.

When using the resistive networks, one must be careful to keep all leads as short as possible. Also note in Fig. 1 that a third connection to receiver ground is required in the case of a balanced input, which is the most common case.

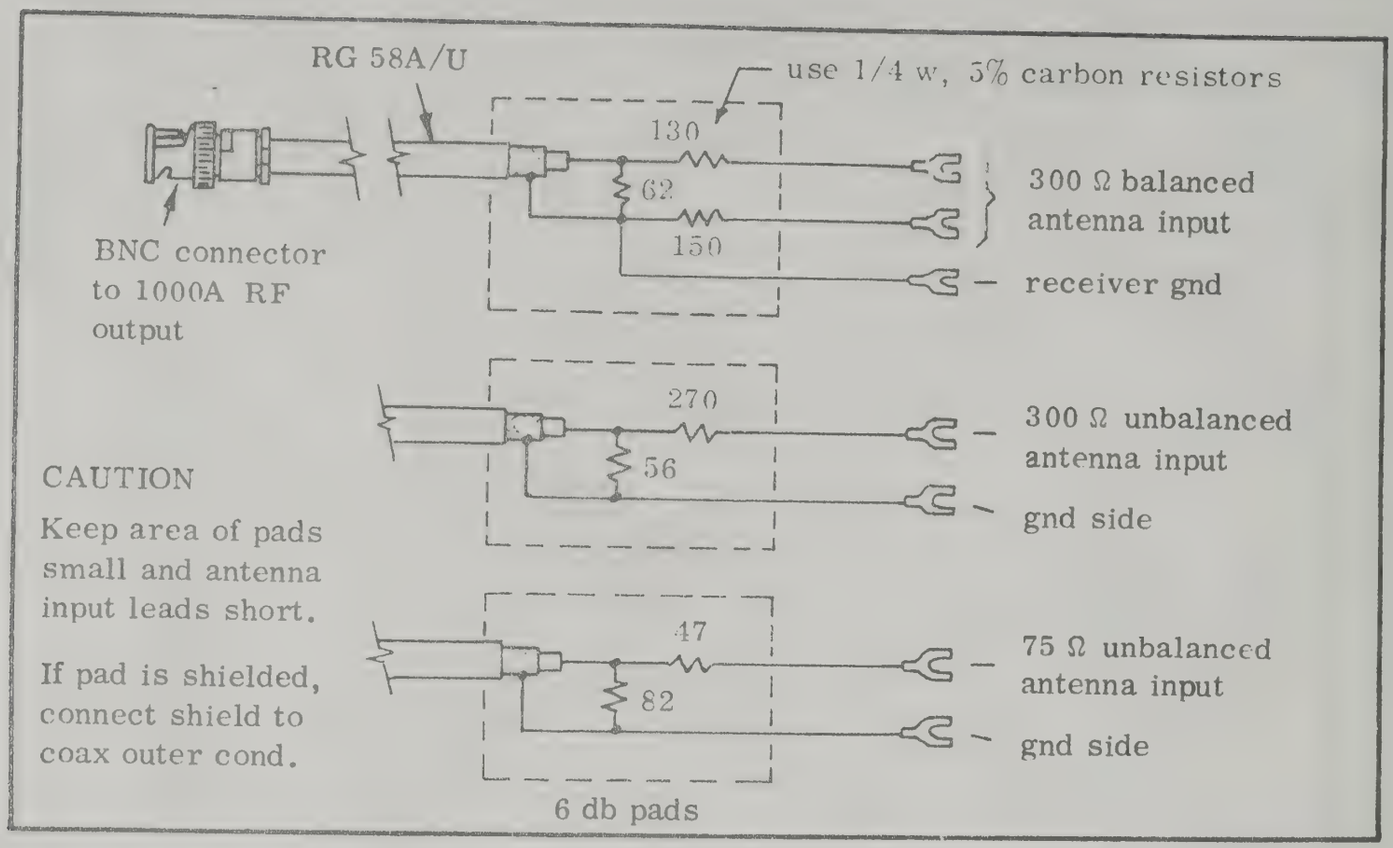


Figure 1. Resistive antenna matching networks

DUAL SWEEP

Connect the 1000A to the receiver or tuner under test and to a scope as shown below in Figure 2.

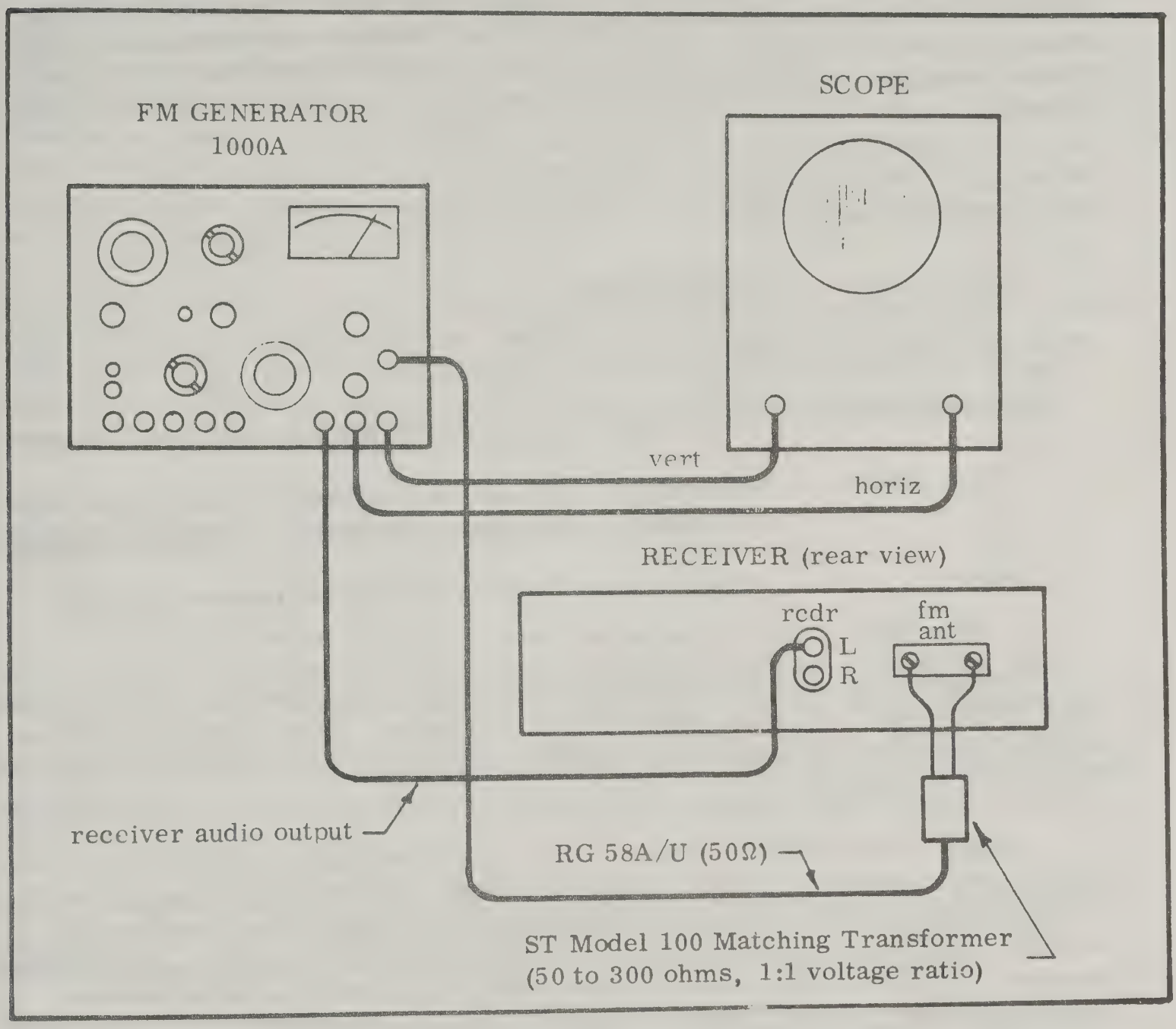


Figure 2. Interconnections for DUAL SWEEP alignment

Set the scope for external horizontal drive and vertical sensitivity of 1 V/cm.

The receiver (or tuner) should be in MONAURAL with MUTING turned off. Tune to a point on the dial where there is no interfering station.

Note that the audio signal in Figure 2 is taken from the tape recorder output (Left or Right side is optional). A BNC-to-Phono Plug cable can be made up, or a BNC-to-BNC cable may be used with a BNC Receptacle-to-Phono Plug adapter such as a Pomona model 2957.

Speaker terminals may also be used, but keep in mind that one side of the 1000A RCVR input is at ground potential. Some receivers have internal feedback from the low side of the speaker terminals, in which case it would be necessary to connect the 1000A RCVR input between the high speaker terminal and ground. If speaker terminals are used, set BASS and TREBLE controls at their normal position and bring the level up being careful not to saturate the 1000A filter/amplifier in the receiver bandpass. It is normal for receiver noise outside the bandpass to cause clipping.

Set up the 1000A as follows:

FUNCTION..... DUAL SWEEP

RF LEVEL ..... Start at 100μV.

SWEEP WIDTH .. Start at 600 kHz. Read sweep width on top scale of meter.

FREQUENCY.... Adjust to get the receiver bandpass centered on the scope. The pattern should appear somewhat as shown in Figure 2.

PHASE..... Adjust to make forward and retrace patterns coincide.

The horizontal axis of the scope display is linear in frequency with peak-to-peak width read directly on the top scale of the 1000A meter. For example, by setting sweep width to 600 kHz and scope horizontal deflection to 6 cm, a horizontal scale of 100 kHz/cm is obtained.

Once the DUAL SWEEP pattern has been centered on the scope, the receiver discriminator and IF strip can be aligned. Amplitude of the 10 kHz signal at a given point on the horizontal axis, as explained on the third page of the data sheet, is proportional to S-curve slope at the corresponding carrier frequency. The receiver is aligned to have a DUAL SWEEP pattern which is as flat as possible (constant amplitude) in the required passband (150 kHz p-p) and symmetrical about the center frequency. Normally the discriminator adjustments will have the greatest effect on flatness; however a detuned IF circuit will degrade the pattern and shift it off to one side. In a critical alignment, final adjustment of the discriminator secondary should be done with SWEEP WIDTH reduced to about 200 kHz and scope sensitivity turned up with a corresponding vertical offset so that the top of the pattern can be viewed.

Words of Caution:

1. On wide sweep widths a large signal comes out of the discriminator, and in some cases one or more audio stages may overload. This can be seen on the DUAL SWEEP pattern as dropouts (signal goes to zero) near the pattern edges or a warping effect on the pattern as the center of the sweep is moved to left or right by tuning the receiver or changing the FREQUENCY dial. In this case it is necessary to reduce sweep width or probe closer to the discriminator to see the response characteristic for a wide sweep. Another method is to reduce RF LEVEL, but the pattern will become increasingly noisy.

2. It is sometimes possible to improve DUAL SWEEP pattern flatness by making adjustments which at the same time reduce receiver sensitivity. In a fringe area alignment should probably favor sensitivity; whereas in metropolitan areas the customer would probably prefer low distortion. In any event, a knowledgeable compromise can be made using the 1000A.

Alignment Hints:

1. It is usually better to align the receiver to have a DUAL SWEEP pattern which is symmetrical rather than making it drop precipitously or bump up at one edge in order to get maximum flatness in a particular 150 kHz part (corresponding to 100% modulation) of the bandpass. An abrupt loss of linearity means that tuning will be critical and also a small amount of drift will cause abrupt distortion. Either of these characteristics are likely to cause more customer dissatisfaction than a small amount of distortion.

2. During the alignment process it is a good idea to run RF LEVEL up and down frequently to be sure that the sweep pattern holds good over the required range. With the piston attenuator it is very easy to check this at each adjustment.

3. The horizontal presentation on the scope is linear in frequency. Receiver bandwidth can be read directly by calibrating the display as described in the setup procedure. Alternatively, if the SWEEP WIDTH and FREQUENCY controls are set to display only that portion of the receiver response to be measured, bandwidth can be read directly on the 1000A meter.

4. A good way to learn the DUAL SWEEP method is to use a dual channel scope and, with the scope display set on CHOPPED, simultaneously view the DUAL SWEEP pattern on one channel and the more familiar discriminator response (S-curve) or IF response on the other channel.

Applications:

1. DUAL SWEEP provides a direct measure of intermodulation distortion, that is, the modulation of a small amplitude, high frequency signal by the presence of a large amplitude, low frequency signal. Peak intermodulation distortion is calculated by taking the maximum amplitude change of either the top or bottom of the pattern over a 150 kHz width at the center of the pattern and dividing this number by the average height of the pattern across the band.

2. DUAL SWEEP measures the distortion from receiver antenna input to the point at which the audio signal is connected to the 1000A RCVR input. If the audio is taken directly from the discriminator output, the audio amplifier stages are excluded. If it is taken from the speaker output terminals, all of the audio stages are included. In this manner it is possible to track down the source of distortion whether it arises in the IF/discriminator part of the receiver or one of the audio stages.

STEREO

Set the FUNCTION switch on STEREO and the INPUT switch on LEFT or RIGHT if the internal audio oscillator is to be used. The OSC LEVEL control is used to set % modulation which is read directly on the FM DEV % scale of the meter. 100% corresponds to 75 kHz peak deviation of the FM carrier. If an external audio signal is used for modulation, set the input switch to EXT and use the signal source level controls to adjust % modulation as read on the 1000A meter.

Pilot level is set by depressing the PILOT TEST pushbutton and adjusting the PILOT LEVEL control for the desired % modulation. When the pushbutton is depressed, internal oscillator and external modulation sources (except auxiliary rear panel input) are automatically removed and the meter scale sensitivity is increased by a factor of ten, thus reading 15% full scale. The FCC specifies that pilot modulation should be between 8 and 10% (between 80 and 100 on the expanded meter scale). After pilot level is set, total modulation can be set at the desired level, usually 100% for receiver testing, by means of the OSC LEVEL control or external signal level. Note that modulation level controls are completely independent in going between the sweep function and any of the other functions.

Setting the INPUT switch to L + R causes the monaural subchannel to be generated by making L = R. Switching to L - R causes the stereo subchannel to be generated by making R = - L. These two modulation functions are useful for aligning matrix type demodulators. They also find application in troubleshooting demodulators and checking left/right balance.

MONAURAL

Set the FUNCTION switch to MONAURAL and the INPUT switch to LEFT/MONO if the internal oscillator is used. The OSC LEVEL control is used to set % modulation which is read on the FM DEV % scale of the meter. The INPUT switch is set to EXT and the LEFT input is used for an external audio signal on MONAURAL.

CAUTION: The internal oscillator will also provide modulation if the INPUT switch is set to L + R or L - R; however distortion will be higher.

CW

Setting the FUNCTION switch to CW removes all modulation and provides a clean RF carrier signal for quieting (signal-to-noise ratio) measurements on receivers. To perform quieting tests, connect an AC voltmeter having a 20 Hz to 15 kHz bandwidth to the receiver recorder output. Measure the output level with the 1000A on MONAURAL and modulation level set at 100%. Then switch the 1000A to CW and measure the output level again. The first measurement divided by the second gives the signal-to-noise ratio. RF LEVEL is normally set at 1000 microvolts for this measurement (2000 μV if one of the 6 db pads is being used). Quieting can easily be measured as a function of RF level by using the RF LEVEL control on the 1000A.

SCA

SCA trap alignment can be conveniently performed by setting the FUNCTION SWITCH to SCA. This removes external modulation, sets the internal oscillator to 67 kHz, and applies this signal to the modulator. Modulation level is variable by means of the OSC LEVEL control.

AUXILIARY FRONT PANEL OUTPUTS

19 kHz: 5 volt square wave primarily used for scope sync when viewing stereo waveforms.

INT OSC: 3 V rms sine wave used primarily for scope sync when viewing receiver waveforms and distortion products at the output terminals of a distortion analyzer. Frequencies appearing here are 1 kHz on MONAURAL and STEREO, 10 kHz on DUAL SWEEP, and 67 kHz on SCA. Because of the low distortion at 1 kHz, this signal is also useful for amplifier testing. Source impedance is 1KΩ.

COMPOSITE: This signal is normally used for separate testing and alignment of stereo demodulators. It consists of the full modulating signal except on DUAL SWEEP and is monitored on the bottom scale, PEAK VOLTS, of the meter. Maximum amplitude is 10 volts peak-to-peak. Source resistance is 600 Ω.

AUXILIARY REAR PANEL INPUT (Option M-1)

This input is intended primarily for external SCA program material but can be used for other modulation requirements. If one wished to do overall intermodulation distortion testing of a receiver at frequencies other than those provided in DUAL SWEEP, the large amplitude, low frequency signal could be applied at the front panel LEFT input (1000A on MONAURAL) and the small amplitude, high frequency signal applied at the auxiliary rear panel input.

This is a true summing input ahead of the metering circuit. Input resistance is 10 KΩ, frequency response is flat to 75 kHz (modulation level should not exceed 50% at 75 kHz), and the level requirement is about 2.4 V rms for 100% modulation.

CIRCUIT OPERATION

The amplifier configuration shown below in Fig 3 is used repeatedly in the 1000A. It will help to understand this circuit before continuing with overall circuit operation.

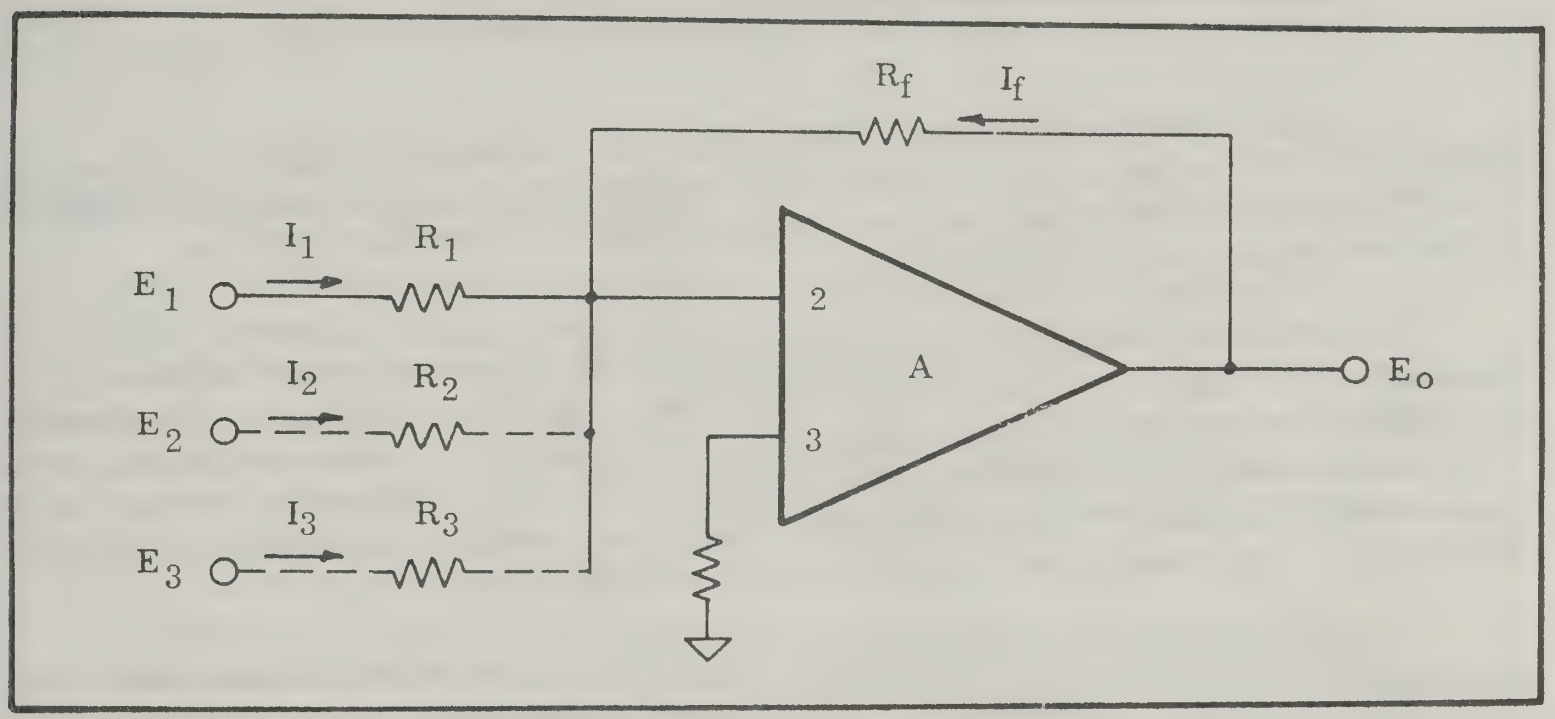


Figure 3. Summing amplifier

Amplifier A in this case is an integrated circuit amplifier with very high voltage gain and high input impedance. A positive voltage at pin 2 causes a negative output swing and a positive voltage at pin 3 causes a positive output swing. In other words, pin 2 is the inverting input and pin 3 is the non-inverting input.

The overall amplifier circuit works as follows: A positive voltage appearing at one of the inputs E_1 causes a current I_1 to flow through input resistor R_1. This causes a positive signal to appear at pin 2 which in turn causes E_o to go negative. E_o forces a current I_f to flow through R_f. Equilibrium is reached when the difference between I_1 and I_f multiplied by the amplifier input impedance is just equal to E_o divided by amplifier gain. For most practical purposes the voltage at pin 2 is reduced to zero and I_1 made equal to I_f. We may therefore write the following equations:

$$I_1 = \frac{E_1}{R_1} = -I_f = -\frac{E_o}{R_f}$$

therefore

$$\frac{E_1}{R_1} = -\frac{E_o}{R_f}$$

or $E_o = -\frac{R_f}{R_1} \times E_1$. The voltage gain is $-\frac{R_f}{R_1}$.

The high gain and input impedance of the IC amplifier causes the sum of currents coming into pin 2 to be very nearly equal to zero, that is, the current flowing in from the inputs must equal the current flowing out through the feedback resistor. Pin 2 is called a current summing point in this particular configuration. By the same arguments we may write the following equation for the case in which there are three inputs.

$$E_o = -\frac{R_f}{R_1} \times E_1 - \frac{R_f}{R_2} \times E_2 - \frac{R_f}{R_3} \times E_3$$

For the following discussion refer to the 1000A schematic diagram. Primary signal flow is from the LEFT and RIGHT inputs across the top of the diagram to the COMP (composite) output and then back down through the linearizer (Q20) and modulator driver (MC5) to the RF unit.

LEFT and RIGHT input amplifiers, MC1 and MC2, serve several purposes. They buffer the inputs and provide a constant input impedance (10Kohm). Remember pin 2 is a summing point and has practically zero voltage with respect to ground. They also provide dc bias and low output impedance for the switching field-effect transistors Q1 and Q2. The dc bias is obtained by summing inputs from the +15 volt supply. This bias is later cancelled by a summing input through R17 to MC3.

The time division multiplex signal is generated by switching back and forth between MC1 and MC2 outputs at a 38 kHz rate and letting the currents, first from one and then the other, flow into the summing point of MC3 through input resistor R16. Q1 and Q2 act as switches -- going to a very high resistance when the gates are driven negative and to a low resistance when the driving voltage goes to zero. At zero the driving voltage source is effectively decoupled from Q1 and Q2 gates by diodes CR1 and CR2. These are depletion mode FET's, and therefore with a low source-to-gate voltage they have a low source-to-drain resistance.

MC3 is used to buffer the multiplex signal and provide a low output impedance for driving the composite filter (circuit containing L1, L2, and L3). It is also used to add in the pilot signal through R30 (another summing input). The purpose of the composite filter is to remove odd-order harmonics of 38 kHz from the multiplex signal and correct the amplitude of the stereo subchannel.

MC4 buffers the filter and provides a high-level, linear, composite signal. The auxiliary, rear-panel input is summed with the filter output through R34.

LINEARIZER and RF CIRCUITS

The RF oscillator is contained in the metal can mounted at the top of the attenuator tube. The circuit is a single transistor (Q30) oscillator with capacitive feedback to the base. Radiation from tank coil L4 propagates down the attenuator tube. The tube is a waveguide operating below cut-off and attenuation down the

tube follows a precise logarithmic law. The output pick-up loop and its associated components are mounted on a probe which is moved up and down the tube by the RF LEVEL control.

The RF oscillator is frequency modulated by a varactor diode CR21 connected in the tank circuit. The varactor diode has a capacitance which is related to the voltage appearing across it. The resultant voltage tuning characteristic is not linear and in order to have a linear modulator it is necessary to provide a compensating non-linearity. This is the purpose of the field-effect transistor Q20 which is biased into a region to best compensate the non-linearity. Emitter follower Q5 and its surrounding circuitry provides a low-impedance, adjustable bias source. Amplifier MC5 buffers the linearizing amplifier and provides a low impedance drive to the RF unit.

SUBCARRIER and PILOT GENERATOR

Both the 38 kHz subcarrier and the 19 kHz pilot signal are derived from the 152 kHz crystal oscillator comprised of crystal Y1 and one-half of MC7. This half of MC7 is connected as an amplifier with the crystal in the feedback loop. The output is amplified by Q21 and divided down to 76 kHz by the other half of MC7 wired as a binary divider. Dual flip-flop MC8 is used to further divide down to 38 kHz and 19 kHz. Q3 and Q4 provide the 38 kHz drive to the analog switching circuits described above.

Output of MC8B is a 19 kHz squarewave. This signal is converted to a sine wave by MC6 which is wired as a double integrator. The chief characteristic of the double integrator is a low frequency roll-off at 16 db /octave, thus it is able to eliminate the harmonics of the squarewave input. Since it is not a "perfect" integrator, it has a slight phase shift which is corrected by the circuit consisting of R92, R93 and C32. By means of R93 it is possible to adjust the phase over a 4° range.

INTERNAL OSCILLATOR

This is a Wien bridge oscillator built around IC amplifier MC9. When the peak output voltage exceeds the voltage on the base of Q7, the gate of Q8 is driven more positive, thus increasing the source-to-drain resistance and increasing the negative feedback around MC9. Q8 acts simply as a voltage controlled resistor. R105 is used to put the circuit in the proper operation region and is used to adjust oscillator distortion. Q6 in the level detecting circuit acts as a buffer and also provides temperature compensation for Q7. CR4 and CR5 prevent emitter-base breakdown.

The phase splitter circuit, Q9, is used to provide the input signals for generating the monaural (L + R) and stereo (L - R) subchannels. Since some distortion is introduced here, these two positions of the INPUT switch should not be used for receiver distortion measurements.

METER CIRCUIT

The peak-reading meter circuit is based on a summing amplifier configuration. It is used to monitor the composite output level.

If feedback current through the meter drops below the peak input current determined by peak input voltage (positive swing) and R140 and R141, output of MC10 will swing far enough negative to increase the charge on C69 and thereby increase the feedback current. Feedback current through M1 continues full time. Except at times corresponding to the positive input peaks, MC10 output swings slightly positive to produce a counteracting feedback current through CR6.

Q12 isolates the output of MC10 from the meter feedback path. R147 and C69 determine the discharge time constant and therefore the low-frequency response of the meter circuit.

C70 and R139 form a high-frequency compensating circuit. R143 and R142 are switched in on PILOT TEST to increase meter sensitivity by a factor of ten.

DUAL SWEEP FILTER/AMPLIFIER

The purpose of this circuit is to provide very high rejection of 60 Hz and an amplifier with a frequency response peaking at about 10 kHz. A high-pass filter consisting of C60, R130, C61, and R131 leading into the gate of field effect transistor Q10 provide the required low frequency rejection. Feedback capacitor C63 around amplifier Q11 provides the high-frequency roll-off.

POWER SUPPLY and SWEEP CIRCUIT

Integrated circuit MC11 contains the regulating amplifier and reference zener for the +15 volt supply. R165 and R166 form the feedback reference divider, and R164 sets the current at which short circuit protection occurs. Q13 is the series regulator for the +15 and is driven from MC11.

The -15 volt supply is referenced to the +15 through divider R172 and R173. The circuit regulates to keep the base of Q17 at zero volts. Q16 and Q18 amplify the error signal to the base of Q14 which is the series regulator for the -15. R176 in conjunction with Q19 provide short circuit protection, turning off Q18 and Q14 as current exceeds the prescribed limit.

Q15 is an emitter follower to provide the +5 volts from the +15. The +5 achieves its short circuit protection from the protection built into the +15 supply.

One winding of the power transformer (3 - 5) is used to supply the horizontal sweep voltage and low-frequency modulation voltage in DUAL SWEEP. The voltage is first filtered by R21, R22, and C85, then it is applied to the phase shifter circuit. Varying R162, the SWEEP PHASE control, changes the phase of the modulation signal with respect to the HORIZ output voltage. A special feature of this type of phase shift network is that amplitude changes very little with a change in phase.

INTERNAL ADJUSTMENTS

+5 Volt Supply - R168

Measure the +5 volt supply at the emitter of Q13 (see Fig 7 on separate page at back of manual). Nominal value is 5.4.

Crystal Oscillator - C20

Set FUNCTION switch to STEREO. Connect a counter to the end of C20 opposite the X'tal (underside of board). This is the same as pin 6 of MC7 but a more convenient test point. Connect to the counter with clip leads to avoid excess capacitive loading. Adjust C20 for 152.000 kHz. The 19 kHz output may be used instead, but a 10 second gate time will be required to get sufficient resolution. A counter with sufficient accuracy to insure meeting the .01% requirement of FCC specifications should be used.

L/R Gain Balance (38 kHz Subcarrier Suppression) - R1, R7

Set FUNCTION switch to STEREO, INPUT switch to L + R, PILOT LEVEL full off, OSC LEVEL to approximately 100% deviation. Connect a scope to COMP output, sync on INT OSC output.

Observe the positive peaks of the COMP output waveform with scope gain as high as possible. Adjust R1 to remove the 38 kHz ripple seen here.

Observe the negative peaks (invert scope polarity or slide the pattern up), and adjust R7 to remove the 38 kHz ripple seen here. Repeat adjustment of R1 and R7 several times since they are interacting.

Turn OSC LEVEL full off and make final adjustment of R7 for minimum 38 kHz at COMP output.

DC Balance - R19

Set FUNCTION switch to STEREO, INT OSC control full off. Adjust R19 for minimum dc voltage (< 20 mV) measured at the COMP output.

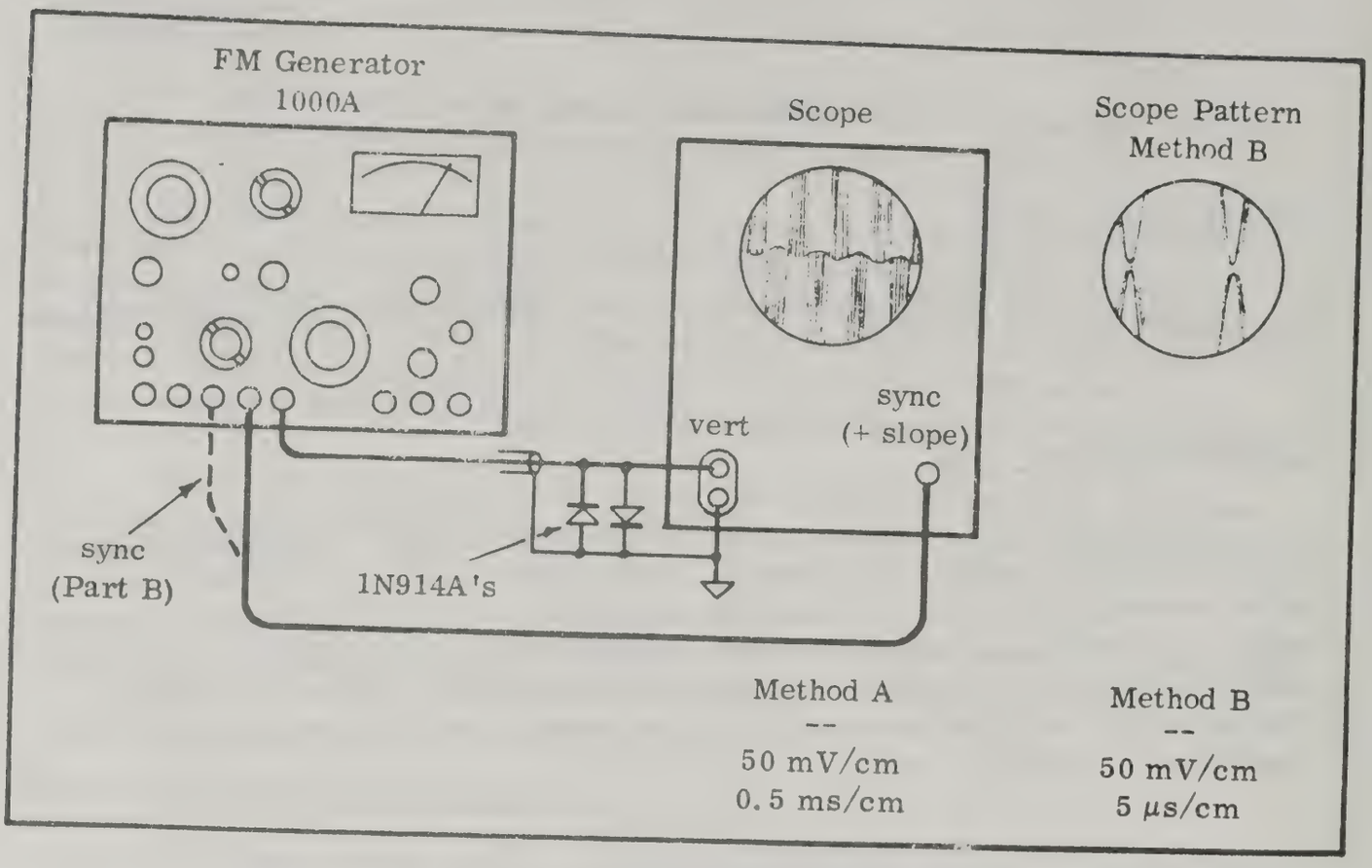


Figure 4. Setup for checking stereo separation

MONO/STEREO Subchannel Separation (See page 13A if unit is equipped with option M3)

This adjustment should not be attempted unless a high quality, wide-band scope is available. To be on the safe side, the scope should have a dc to 10 Mhz response. Vertical sensitivity should be at least 50 millivolts/cm at DC. Do not use AC coupling and do not use a scope probe. A slight misadjustment of the probe could cause an apparent lack of separation.

Method A

Connect the COMP output to the scope vertical input (as shown in Fig 4) with two high speed silicon diodes such as 1N914A's across the scope input. The purpose of the diode is to clip the input voltage and reduce scope overload. Sync the scope on INT OSC output and set sweep speed to 0.5 ms/cm, vertical sensitivity to 50 mV/cm.

Set FUNCTION switch to STEREO, INPUT switch to LEFT, PILOT LEVEL full off, and OSC LEVEL to 5 volts peak on the modulation meter. Adjust R35 and R38 for maximum base line flatness. Start R38 at one end and slowly rotate while constantly seeking minimum base line ripple with R35.

CAUTION: Check possibility of scope overload by reducing vertical sensitivity and seeing that the centimeters of base line ripple reduces accordingly.

Option M3 Separation Adjustment

If option M3 has been installed, variable resistors R35 and R38 have been omitted. The composite filter is now mounted on a side panel and is permanently adjusted at the factory.

With option M3, low frequency separation can be independently adjusted with a LEFT signal only (adjust R200) or a RIGHT signal only (adjust R201). The test signal may have a frequency anywhere between 50 Hz and 1 kHz. Use either Method A or Method B to observe separation on a scope.

Method B

Synchronize the scope on the 19 kHz output and set sweep speed to 5 μs/cm. A series of opposing zero cusps will appear (see sketch in Fig 4) at 26.3 μs intervals (38 kHz period). These "zero" points occur at the instant the composite waveform would be sampled to determine the voltage at the right input. Changing the INPUT switch to RIGHT shifts these points 13.16 μs with the level at the "zero" points now representing the left input.

Adjust R35 and R38 to minimize the voltage levels occuring at the "zero" points and to make the cusps symmetrical. Normally the optimum condition will result in a slight separation of the opposing cusps on either the LEFT or RIGHT position and a slight overlap on the other position of the INPUT switch. With the composite level set at 5 volts peak, the peak-to-peak separation or overlap at the "zero" points should be less than 20 mV.

To optimise separation over the full audio frequency range, turn the INPUT switch to EXT and connect an external audio oscillator set at 5 kHz with sufficient output to bring the composite level to 5 volts peak. Now adjust R35 and R38 to make the opposing cusps symmetrical and just touch at the center.

FM Modulator Linearity - R52

A discrimimator which is either linear or has a known non-linearity is required to adjust the linearity of the 1000A modulator. The following method can be used to determine the linearity of a discriminator.

The discriminator is measured just the same as if you were using the DUAL SWEEP function of the 1000A -- with one important difference. The two-signal modulation is achieved by mixing the outputs of two FM generators as in Fig 5, one -- the 1000A -- having the 60 Hz sweep modulation and the other -- the auxiliary generator -- having a 10 kHz modulating frequency with $\approx$ 7.5 kHz peak deviation. The difference frequency from the balanced mixer (Hewlett-Packard 10534A or equivalent) contains both modulations; however, with this setup, amplitude of the 10 kHz modulation is independent of the 1000A carrier frequency.

The 1000A is set on DUAL SWEEP and the built-in filter/amplifier is used to generate the familiar DUAL SWEEP pattern (see Fig 5). However the auxiliary FM generator supplies the 10 kHz modulation, and so the 1000A internal 10 kHz modulation must be removed. To do this, take the cover off the 1000A (see Fig 6) and connect a clip lead between chassis ground and the pole of S1-3. This kills the internal oscillator which supplies the 10 kHz in DUAL SWEEP. S1-3 is on the front wafer of the FUNCTION switch. The terminal to be grounded is at the top and has a grey lead connected to it. The other terminal at the top of this wafer is ground (black lead).

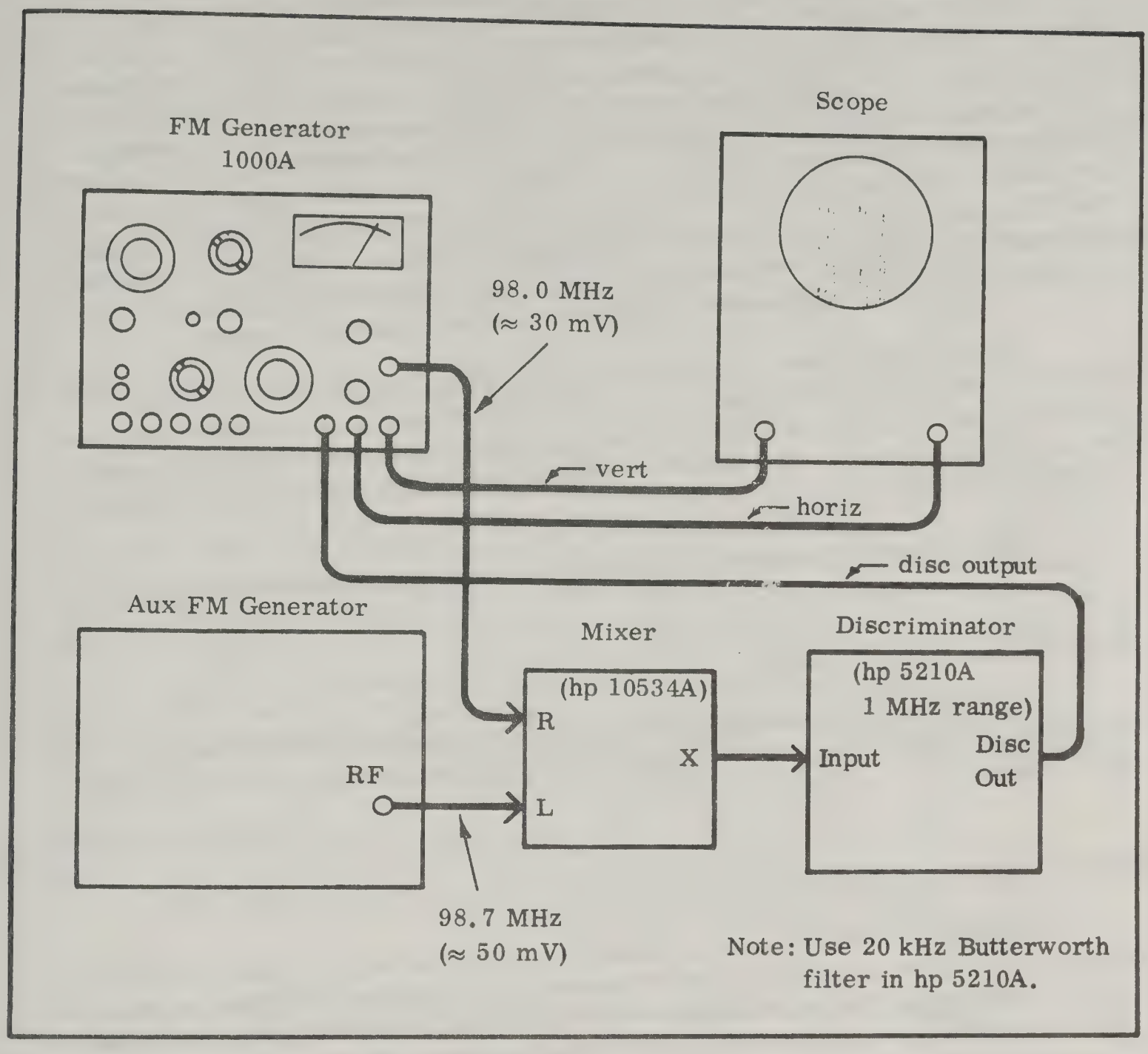


Figure 5. Interconnection for linearity tests

In the example of Fig 5 the discriminator is a Hewlett-Packard 5210A Frequency Meter set to the 1 MHz range. The two generators are set to have center carrier frequencies 700 kHz apart (98 and 98.7 MHz). If a 10.7 MHz discriminator were used, the auxiliary generator would be set at 98 + 10.7 or 108.7 MHz. The test frequencies aren't critical, but the 1000A should be somewhere between 96 and 98 MHz. The auxiliary generator can be either above or below the 1000A frequency. Discriminator tests and subsequent adjustment of R52 should be done at a sweep width of ≈300 kHz.

If the 5210A is available it should be used with one of the active plug-in filters. A good choice would be the 10 to 100 kHz Output Filter Assembly with resistors chosen for a 20 kHz Butterworth roll-off (see 5210A manual). Discriminator output is fed back to the 1000A RCVR input just as in the DUAL SWEEP mode. HORIZ and VERT outputs of the 1000A are connected to a scope to get the DUAL SWEEP type display.

Vertical gain of the scope should be set as high as possible with a corresponding vertical offset in order that the top of the pattern may be viewed. An effective height of 35 cm means that a pattern tilt of less than 0.3 cm (sweep width = 300 kHz) is required to insure an equivalent total harmonic distortion of less 0.1% at 100% modulation. Pattern tilt can be seen more easily by making the horizontal display narrow. An effective way to see the tilt is to vary the 1000A sweep width up and down between 0 and to 300 kHz. Using the 5210A it should be possible to vary the carrier frequency of either generator slightly (thus varying the difference frequency) to find a flat segment of the discriminator. A suitable alternative is simply to record the tilt. RF levels from the two generators must be sufficiently high that changes in level do not affect apparent linearity.

Having either found a linear segment on the discriminator or recorded the tilt, turn off the modulation of the auxiliary generator (leave carrier frequency untouched) and remove the clip lead from the 1000A. Now both modulating signals are coming from the 1000A and R52 is adjusted to obtain the same sweep pattern as observed above.

After adjusting linearity, the modulation level accuracy should be checked.

Modulation Level - R47, R95

In order to adjust modulation level, it is necessary to have a standard. The standard can either be another generator with known accuracy or a calibrated discriminator.

Standard Generator Method

If another generator is used, measure receiver output with 100% modulation (monaural) using the same modulating frequency as the internal oscillator in the 1000A. Then connect the 1000A in place of the standard generator, set modulation to 100% (monaural) and adjust R47 for the same receiver output.

Adjusting sweep width (R95) using a standard generator is more difficult because of limited receiver bandwidth. One must either calibrate at the low end of the meter scale -- say 200 to 300 kHz sweep width -- or go into the receiver just ahead of the discriminator. Some receivers also have a wider bandwidth at high signal levels. In any event, R95 is adjusted to make the receiver output the same for the standard generator having a peak deviation at 60 Hz modulating frequency equal to one-half the 1000A sweep width. For this adjustment the 1000A is set on DUAL SWEEP.

Calibrated Discriminator Method

The calibrated discriminator method utilizes a setup similar to that shown in Fig 5 for the linearity adjustment. However, in this case discriminator output is fed to an AC voltmeter instead of the RCVR input of the 1000A. The discriminator

can be calibrated at dc by shifting the difference frequency a known amount. The dc frequency shift should be measured on a counter. If the Hewlett-Packard 5210A is used, the discriminator output is calibrated by a rear panel control according to the 5210A manual (a calibrating crystal is included in the 5210A). After calibration, the shorting plug board is removed from the 5210A and the appropriate active filter (same one as used above) is plugged in. Range is set to 1 MHz and DISC OUT read directly on an AC VTVM.

Set 1000A FUNCTION switch to MONAURAL, INPUT switch to LEFT/MONO, OSC LEVEL to 150%. Adjust R47 for 79.5 mV rms. Now switch the 1000A to DUAL SWEEP, and with SWEEP WIDTH set to 600 kHz adjust R95 for 212 mV rms.

Internal Oscillator - R105

Connect a distortion analyzer such as the Hewlett-Packard 333A to the 1000A INT OSC output. Set the 1000A to MONAURAL and adjust R105 to get total harmonic distortion of approximately -64 dB ($\approx$.06%). Note that it is possible to get much lower THD, but the oscillator becomes harder to start as the distortion is reduced. As a final check, particularly when R105 has been set for a very low THD, make sure the oscillator is still working on DUAL SWEEP (10 kHz) and SCA (67 kHz).

If a distortion analyzer is not available, look at the INT OSC output with a scope. R105 should be adjusted so that the oscillator is just into the safe start-up region when switching between DUAL SWEEP, MONAURAL or STEREO, and SCA. Normally, start-up will be slowest in MONAURAL or STEREO.

Internal Oscillator - R95 (Option M-2)

After adjusting R105, adjust R95 for the same THD at 400 Hz ($\approx$-64 dB).

Pilot Phase - R93 (Do this only after checking mono/stereo subchannel separation, page 13)

Connect a scope to the 1000A COMP output. Synchronize the scope on the INT OSC output. Set scope vertical sensitivity to 0.05 V/cm. Sweep speed is not critical. In the figures shown below (internal oscillator frequency 1 kHz) sweep speed was set to 0.2 ms/cm with the sweep magnifier on X5. Set 1000A FUNCTION switch to STEREO, INPUT switch to L-R. With PILOT LEVEL all the way down, adjust OSC LEVEL for approximately 25% modulation.

Adjust scope to get the L-R crossover pattern shown in Fig 9A. Now turn PILOT LEVEL all the way up (meter will read $\approx$ 50% modulation). The bright points of the pattern should move out on a horizontal axis as in Fig 9B. If there is a tilt as in Fig 9C, adjust R93 to remove the tilt. An end-to-end tilt of 20 mV corresponds to a pilot phase error of $\approx$ 0.6°, which is more than adequate to assure 60 dB separation assuming perfect mono/stereo subchannel separation (perfectly flat base line with L only or R only input).

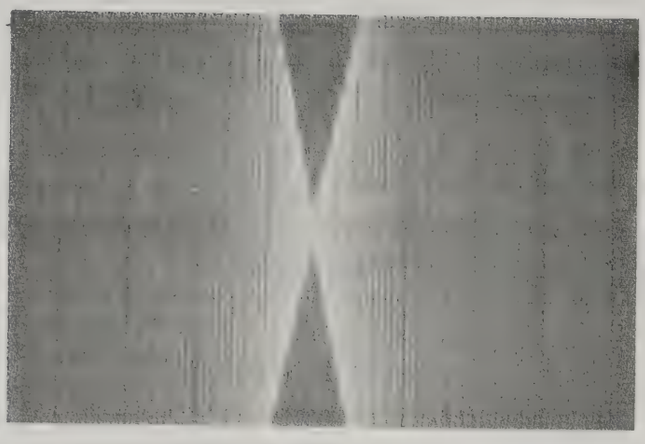


Fig 9A. L-R crossover, 25% modulation, no pilot, 0.05 V/cm.

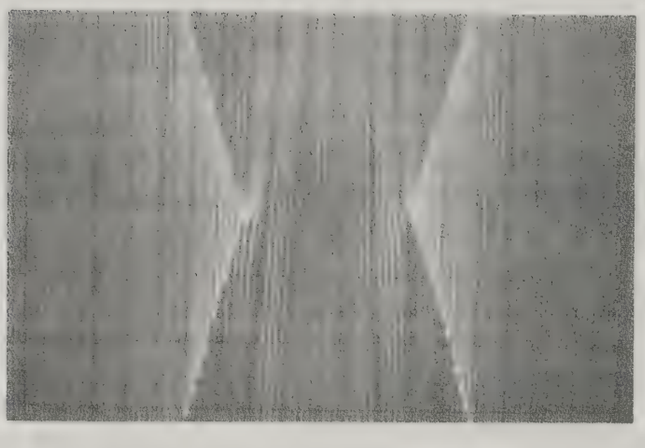


Fig 9B. Pilot level control all the way up. Correct phase.

Bright spots occur where pilot amplitude equals twice the L-R subchannel amplitude. Spots move out horizontally if pilot and subchannel signals cross zero at the same time.

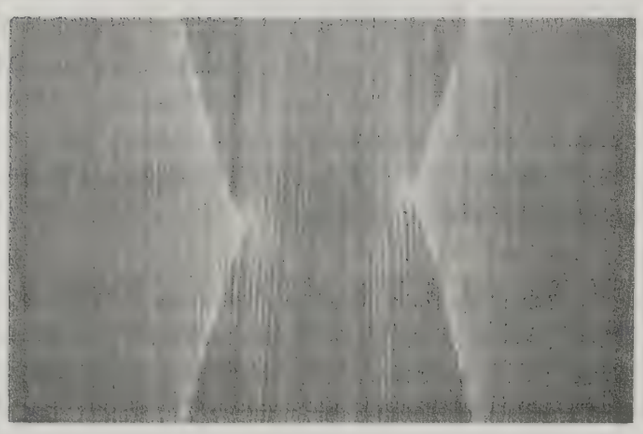


Fig 9C. Tilt corresponding to phase error of $\approx 0.6°$. (1.75° pilot phase accuracy required for 60 dB separation, assuming perfect base line flatness.)

Fig 9. Composite waveforms for setting pilot phase - R93.

L - R Balance - R118

Connect a scope to the 1000A COMP output. Set sweep speed to 2 ms/cm and sync on the INT OSC output. Set 1000A FUNCTION switch to STEREO, INPUT switch to L - R. Turn PILOT LEVEL full off and OSC LEVEL to about 10 V p-p on the scope (5 V peak on the 1000A meter).

Adjust R118 so that adjacent positive and negative peaks are as nearly equal as possible.

C16 - RF Stereo Separation

Connect scope vertical input to FLT 102 (one of the two feed-thru inputs to the RF unit - violet wire). To reduce noise on the signal, isolate the scope input at the RF unit with a 470 Ω resistor. Do not use a scope probe and keep the length of the shielded lead to the scope (RG 58 U or equivalent) under 4 feet. Set scope vertical sensitivity to 10 mV/cm. Now, having already adjusted stereo separation at the COMP output, adjust C16 for optimum separation at FLT 102. Method B (page 14) is the preferred method for observing separation. Separation (or overlap) of the "zero" cusps should be less than 2 mV.

CAUTION: Check possibility of scope overload by reducing vertical sensitivity of the scope. Separation (or overlap) of the "zero" cusps should reduce accordingly.

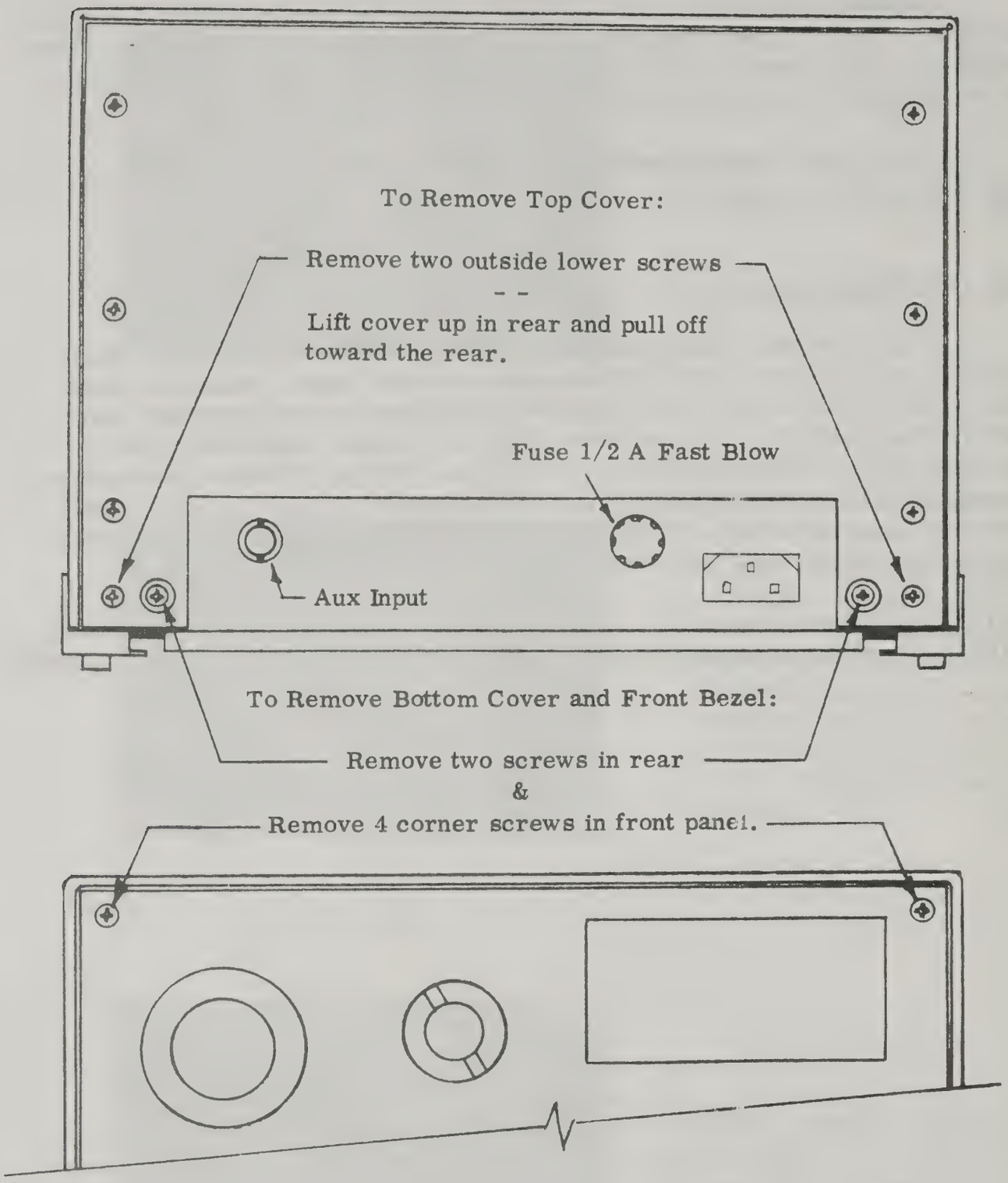

To Remove Top Cover:
Remove two outside lower screws
- -
Lift cover up in rear and pull off
toward the rear.
Fuse 1/2 A Fast Blow
Aux Input
To Remove Bottom Cover and Front Bezel:
Remove two screws in rear
&
Remove 4 corner screws in front panel.

Figure 6. Cover removal

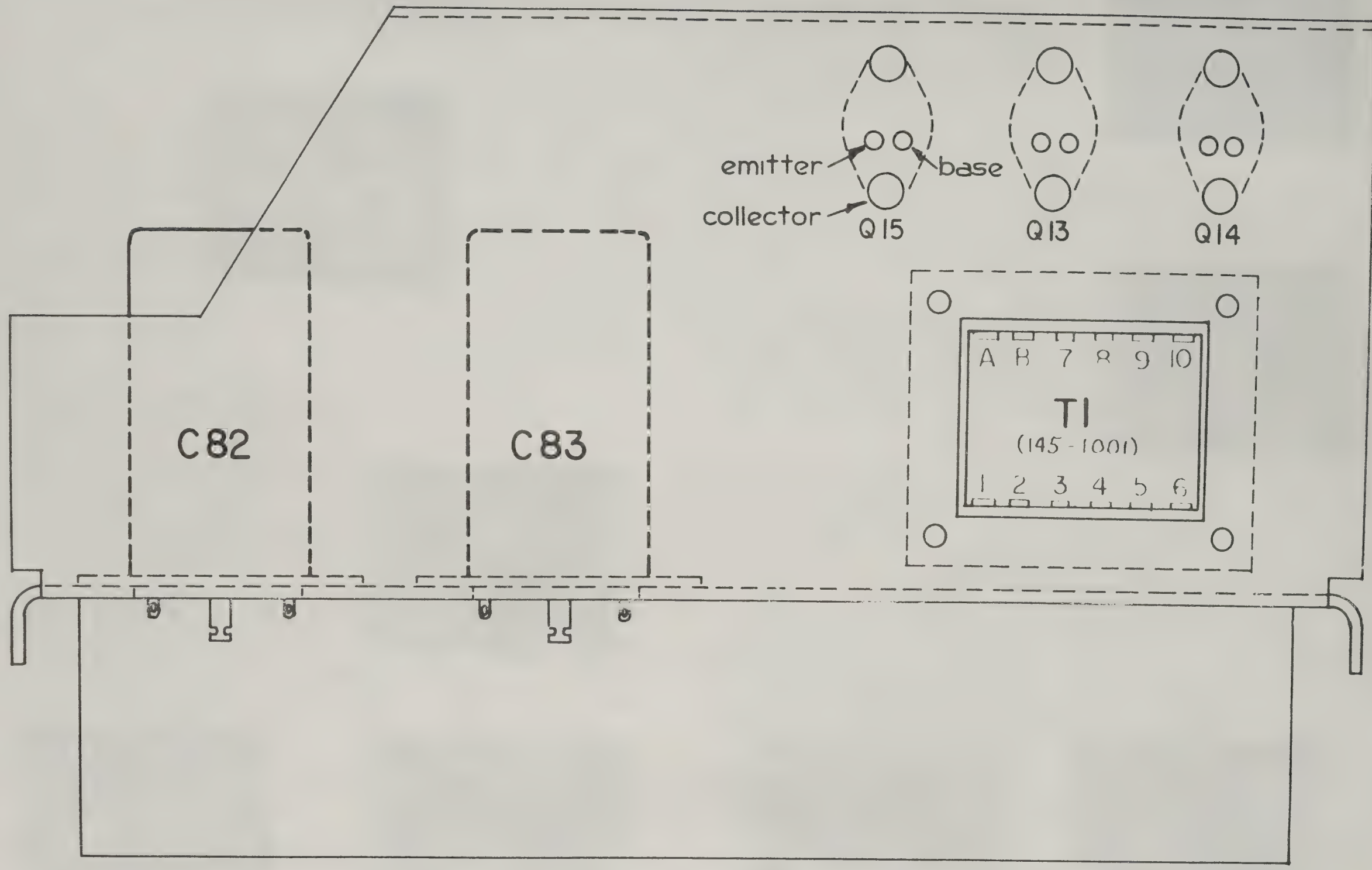


Figure 7. Chassis parts layout

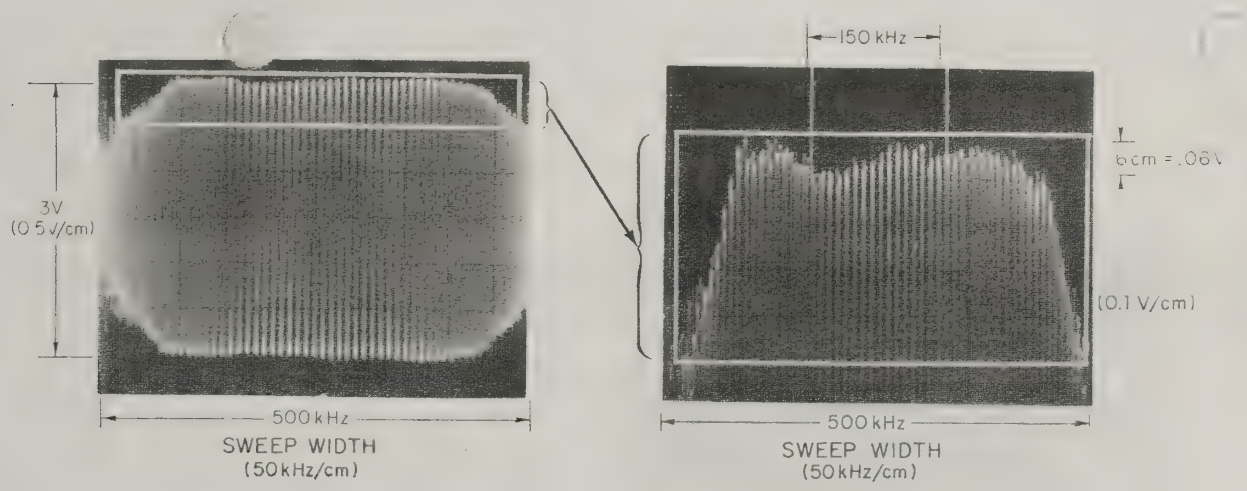


Fig. 4(a). Fig. 4(b)
Top of alignment pattern in (a) is magnified 5 times in (b) to facilitate measuring ripple. Ripple across top is caused by receiver non-linearity and is a direct measure of the receiver's peak intermodulation distortion. Numbers are discussed in article.

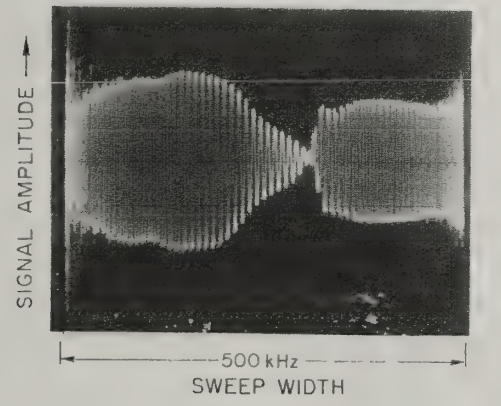


Fig. 5. Two-plateau receiver alignment pattern caused by mis-aligned receiver. This receiver tunes in same station at two adjacent points on dial. Narrowness of pattern plateau means receiver has inadequate bandwidth for high modulations and is hard to tune to stations.

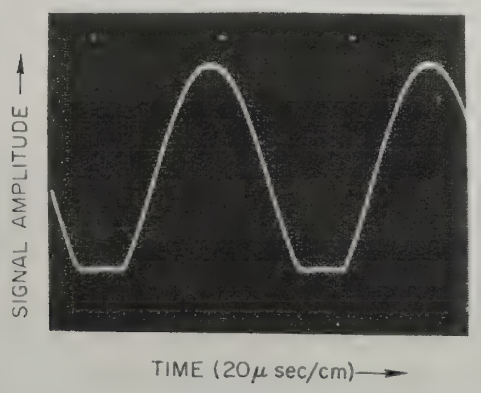
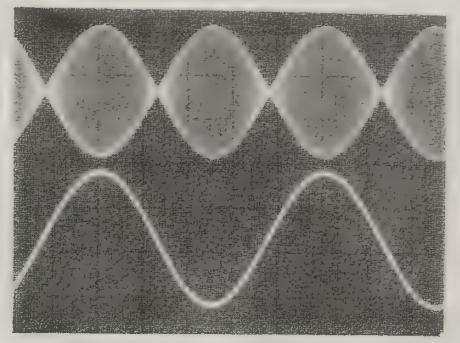
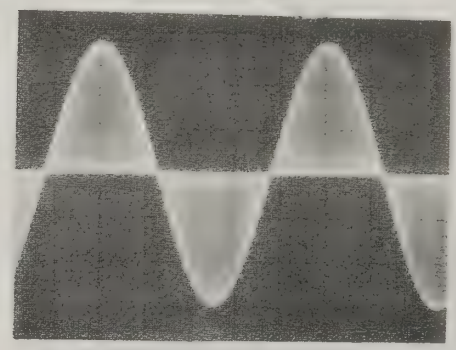
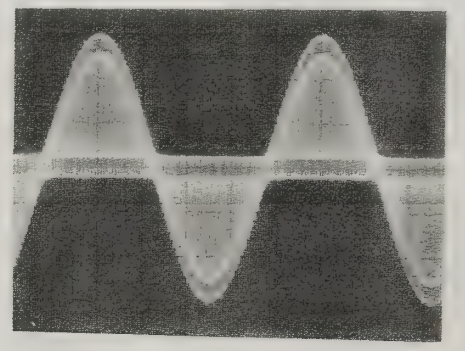


Fig. 6. Audio test signal obtained from receiver of Fig. 5 when receiver was tuned to right-hand plateau in Fig. 5. Noise visible on waveform peaks and severe clipping on waveform troughs is caused by narrowness of plateau in Fig. 5.


(a)


(b)


(c)

(a). Upper trace shows L - R signal and lower trace L + R signal (both 1 kHz) from new generator. These signals are obtained merely by switching generator's input switch between adjacent positions.

(b). Generator's left only (or right only) composite signal without pilot. This output is obtained by switching to third position on generator's input switch.

(c). Generator's composite signal, as in (b), but now with pilot added. Pilot is added merely by turning up generator's oscillator level control.

Fig. 7. Stereo signals produced by new Sound Technology FM Alignment Generator.

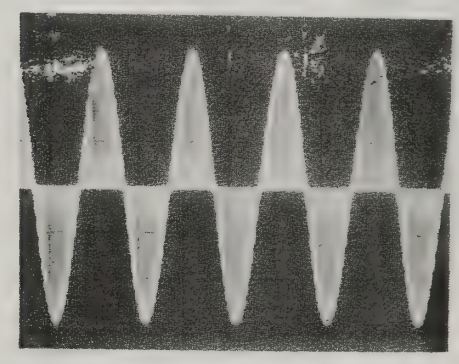
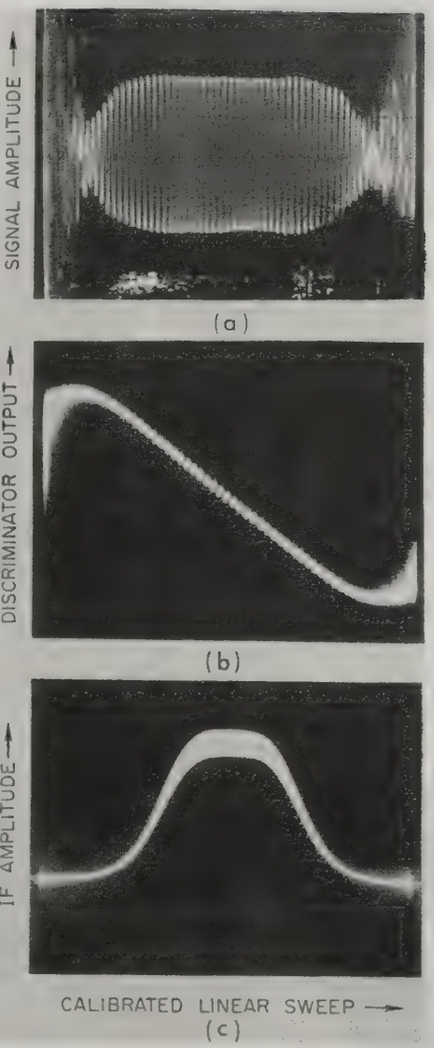


Fig. 8. Same as Fig. 7(b) except on slower time scale to illustrate generator's high channel separation of 50 dB or more (indicated by flatness of base line).



CAPTIONS

(a). Typical alignment pattern obtained with technique discussed in article. The envelope of this pattern tells you how much audio distortion exists in the receiver and how well the receiver is aligned. If receiver is poorly aligned, the envelope will usually have excessive ripple across top and bottom. It may also have humps or abrupt drop-offs.

(b). Typical receiver S-curve obtained with setup of Fig. 3, except scope vertical input comes directly from discriminator test point. Ripple on curve is 10 kHz produced by generator. This 10 kHz signal, when separated from low-frequency sweep signal, forms alignment pattern shown in Figs. 1(a) and 4.

(c). All of the usual sweep generator functions are obtainable with the new generator. Here is the typical receiver i-f curve as obtained with the setup of Fig. 3, except that scope vertical input is now taken from receiver i-f test point.

Fig. 1. Sweep alignment patterns obtained using generators described in article. Horizontal scale is carrier frequency; sweep width here was set to 750 kHz to show response to well past band edges. Sweep width on generator is meter-calibrated to 600 kHz but may be set to as wide as approximately 800 kHz.

Fig. 2. New FM Alignment Generator is basically a very high performance f-m transmitter which produces all signals needed for mono and stereo receiver testing in 88 to 108 MHz range. Distortion in unit's r-f output is truly negligible -- less than 0.1% mono, 0.2% stereo -- while stereo separation is more than 50 dB. Generator also has a special sweep, unique to this instrument, to produce patterns shown in Fig. 1(a) and 4. Instrument is designed and produced by Sound Technology of Cupertino, Calif.

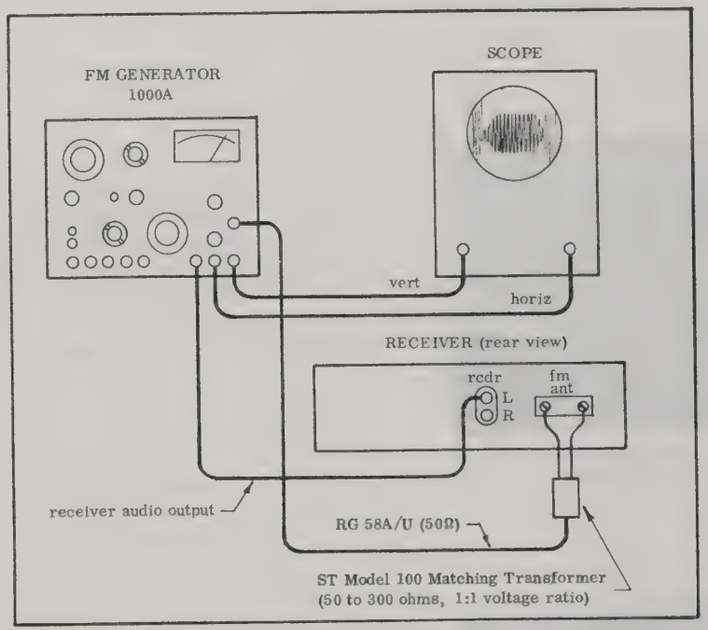
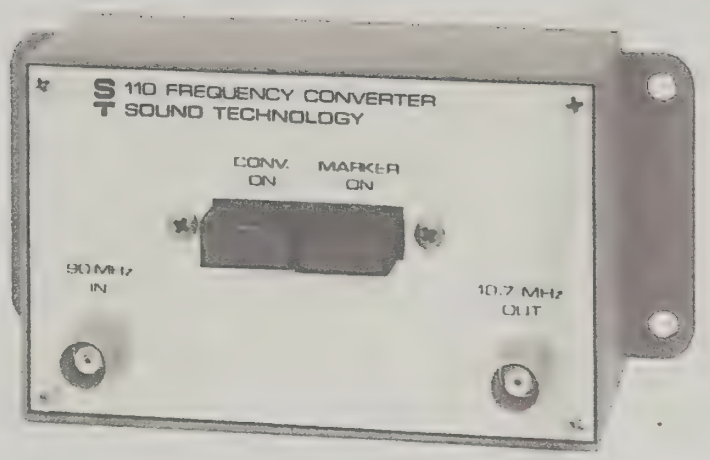


Fig. 3. This one simple setup is all you need to align a receiver and measure its distortion. Note that receiver output is routed through generator.

Model 110

FREQUENCY CONVERTER

Receiver trouble shooting is simplified by the Model 110 Frequency Converter. All functions of an fm signal generator are converted to IF frequencies by the Model 110, and a 10.7 MHz marker can be superimposed on the signal. When used with the Model 1000A FM Alignment Generator, the Model 110 gives you Sweep, Dual Sweep, FM Multiplex Stereo and Mono signals at 10.7 MHz. Instrument can be hand held or permanently mounted. Operates on 9V transistor battery. Input and output connectors are BNC. BNC to banana plug adapter is also provided.



SPECIFICATIONS

Marker Accuracy:	.02%
Conversion Efficiency:	Approx 1:1 no load
Max. Input Level:	200 mv rms
Dimensions:	5-1/4" x 2-5/8" x 2-1/8"
Weight:	12 oz
Shipping Weight:	2 lbs

Model 120

FM DIAL CALIBRATION STANDARD

The Model 120 FM Dial Calibration Standard provides 90 and 106 MHz crystal controlled reference signals for precise receiver dial calibration. Eliminate the time you spend hunting for fm stations to use as a reference. Instrument can be hand held or permanently mounted. Operates on 9V transistor battery. Output connector is BNC.

SPECIFICATIONS

Frequency Accuracy:	±.02%
Output Level:	Approx. 3 mv across 50Ω
Dimensions:	5-1/4" x 2-5/8" x 2-1/8"
Weight:	12 oz
Shipping Weight:	2 lbs

SOUND TECHNOLOGY

1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008
(408) 378-6540

how to align stereo receivers

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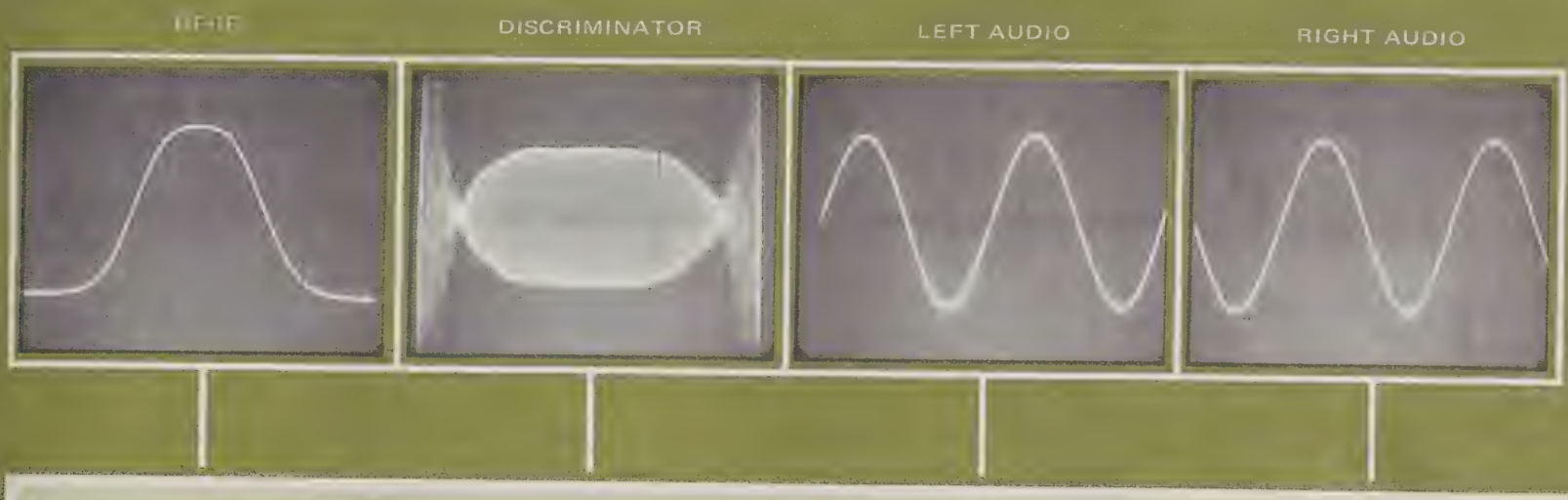

SOUND TECHNOLOGY

1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008
(408) 378-6540

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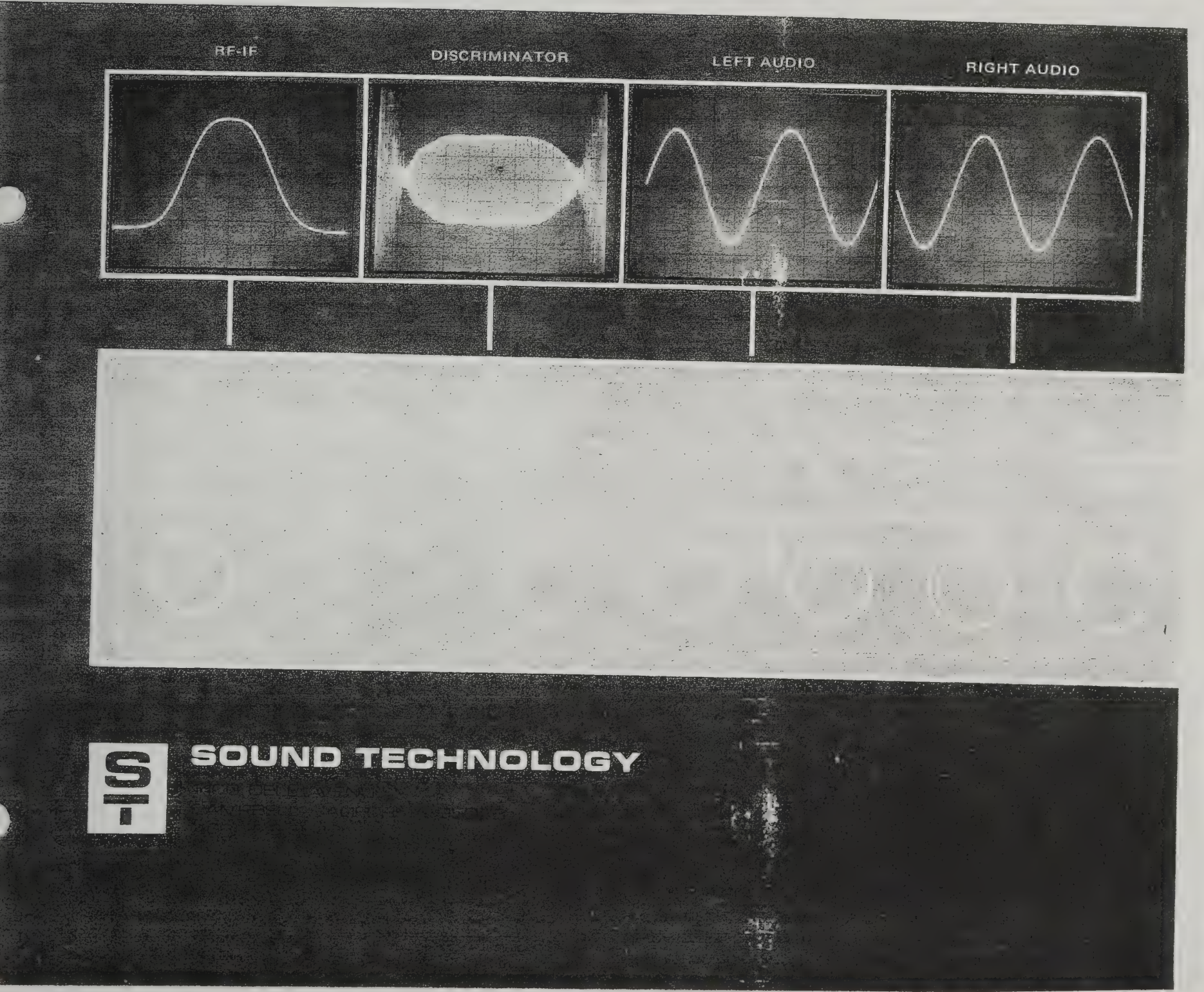
Alignment Chart

Read Detailed Alignment Procedures for additional description and techniques.

STEP	ADJUSTMENT PROCEDURE	SYSTEM CONNECTIONS	MODEL 1000A CONTROLS	RECEIVER CONTROLS	ALIGN FOR
1	IF ALIGNMENT Preferred Method	Figure 1.	**Function:** Dual Sweep **RF Level:** 100 μV or less **Frequency:** Tune to receiver **Sweep Width:** 600 kHz **Phase:** To superimpose scope forward and reverse traces.	**Mode:** Monaural, FM **Muting:** Off **Tuning:** To a dead spot in the fm band	Maximum amplitude and symmetry of the scope display.
1A	IF ALIGNMENT Alternate Method	Figure 3.	**Function:** Monaural **RF Level:** 100 μV or less **Frequency:** Tune to receiver **Input:** Left **Osc Level:** 100% modulation	Same as above.	Sync scope on INT OSC output of 1000A. Reduce RF level below limiting. Align for max audio output.
2	PEAK TUNING METER ADJUSTMENT	—	Same as IF alignment method used except set RF Level to 30 μV.	Same as above.	Fine tune 1000A to center of IF bandpass. Reduce SWEEP WIDTH to zero (or set OSC LEVEL to zero). Adjust for peak reading on meter.
3	LOCAL OSCILLATOR ALIGNMENT	—	Use accurate 90 MHz and 106 MHz sources.	**Mode:** Monaural, FM **Muting:** off **Tuning:** 90MHz for coil slug, 106MHz for trimmer capacitor.	Complete any mechanical dial adjustments first. Align local oscillator for dial accuracy (coil slug at 90 MHz, trimmer capacitor at 106 MHz).
4	RF ALIGNMENT Preferred Method	Figure 1.	**Function:** Dual Sweep **RF Level:** 3 μV to 30 μV **Frequency:** Tune to receiver **Sweep Width:** 600 kHz **Phase:** To superimpose scope forward and reverse traces.	Same as above.	Maximum amplitude and symmetry of the scope display. Adjust coils at 90 MHz, capacitors at 106 MHz.
4A	RF ALIGNMENT Alternate Method	Figure 3.	**Function:** Monaural **RF Level:** 100 μV **Frequency:** Tune to receiver **Input:** Left **Osc Level:** 100% modulation	Same as above.	Sync scope on INT OSC output of 1000A. Reduce RF LEVEL below limiting. Align RF coils at 90 MHz, trimmer capacitors at 106 MHz for max audio output.
5	FM DETECTOR ALIGNMENT Preferred Method	Figure 2.	**Function:** Dual Sweep **RF Level:** 1000 μV **Frequency:** Tune to receiver **Sweep Width:** 250 kHz **Phase:** To superimpose scope forward and reverse traces.	**Mode:** Monaural, FM **Muting:** Off **Tuning:** To a dead spot in the fm band	Tune for symmetrical pattern with flat top. Reduce SWEEP WIDTH to zero and adjust secondary to center zero-tune meter if receiver has one. Increase SWEEP WIDTH to 250 kHz and adjust primary for optimum flatness.
5A	FM DETECTOR ALIGNMENT Alternate Method	Figure 3 except TAPE RCDR OUTPUT of receiver is connected to Total Harmonic Distortion Analyzer.	**Function:** Monaural **RF Level:** 1000 μV **Frequency:** Tune to receiver **Input:** Left **Osc Level:** 100% modulation	Same as above.	Adjust secondary to center zero-tune meter, if receiver has one. Adjust primary for a minimum reading on the distortion analyzer.
6	STEREO DECODER SCA TRAP	Figure 3 SCA test point to scope vertical.	**Function:** SCA **RF Level:** 1000 μV **Frequency:** Tune to receiver **Osc Level:** 30% modulation	**Mode:** Stereo, FM **Muting:** Off **Tuning:** To a dead spot in the fm band	Adjust for minimum 67 kHz on scope. Note: Connection to receiver must be ahead of de-emphasis circuit.
7	STEREO DECODER 19 kHz COILS	Figure 3. Recorder out to scope vertical.	**Function:** Stereo **RF Level:** 1000 μV **Frequency:** Tune to receiver **Pilot Level:** 8% **Input:** Left or Right **Osc Level:** 100% modulation	Same as above.	Gradually decrease pilot level while adjusting coils for max separation.
8	STEREO DECODER 38 kHz COIL	Same as above.	**Same as above except:** **Pilot Level:** 10% **Input:** L – R	Same as above.	Adjust for maximum amplitude of scope display.
9	STEREO DECODER Stereo Separation Control	Same as above.	**Same as above except:** **Input:** Left or Right	Same as above.	Adjust for maximum separation.

how to align stereo receivers

EASILY AND QUICKLY WITH THE SOUND TECHNOLOGY MODEL 1000A FM ALIGNMENT GENERATOR



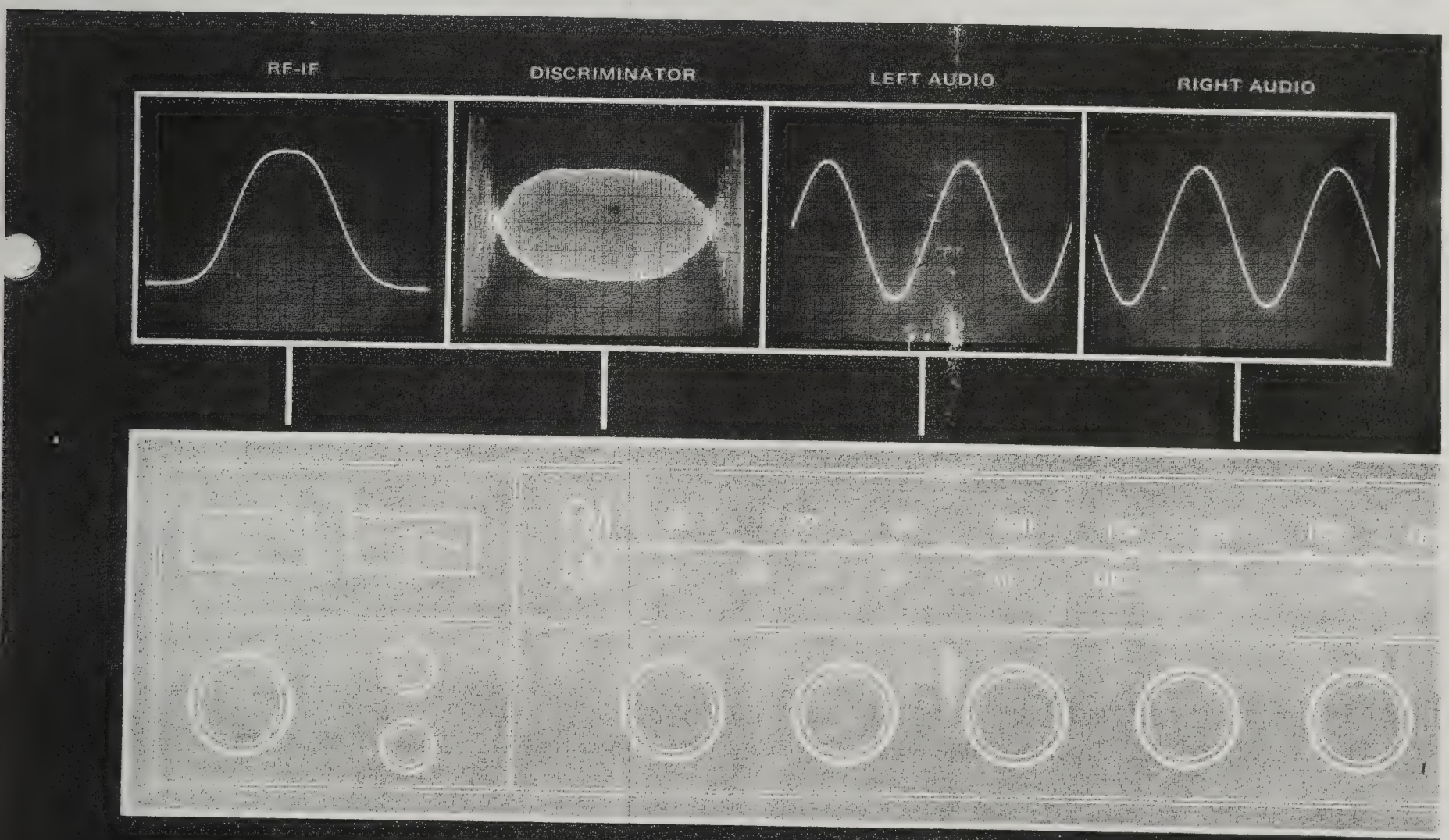
Alignment Chart

Read Detailed Alignment Procedures for additional description and technique.

STEP	ADJUSTMENT PROCEDURE	SYSTEM CONNECTIONS	MODEL 1000A CONTROLS	RECEIVER CONTROLS	ALIGN FOR
1	**IF ALIGNMENT** Preferred Method	Figure 1.	**Function:** Dual Sweep **RF Level:** 100 μV or less **Frequency:** Tune to receiver **Sweep Width:** 600 kHz **Phase:** To superimpose scope forward and reverse traces.	**Mode:** Monaural, FM **Muting:** Off **Tuning:** To a dead spot in the fm band	Maximum amplitude and symmetry of the scope display.
1A	**IF ALIGNMENT** Alternate Method	Figure 3.	**Function:** Monaural **RF Level:** 100 μV or less **Frequency:** Tune to receiver **Input:** Left **Osc Level:** 100% modulation	Same as above.	Sync scope on INT OSC output of 1000A. Reduce RF level below limiting. Align for max audio output.
2	**PEAK TUNING METER ADJUSTMENT**	—	Same as IF alignment method used except set RF Level to 30 μV.	Same as above.	Fine tune 1000A to center of IF bandpass. Reduce SWEEP WIDTH to zero (or set OSC LEVEL to zero). Adjust for peak reading on meter.
3	**LOCAL OSCILLATOR ALIGNMENT**	—	Use accurate 90 MHz and 106 MHz sources.	**Mode:** Monaural, FM **Muting:** off **Tuning:** 90MHz for coil slug, 106MHz for trimmer capacitor.	Complete any mechanical dial adjustments first. Align local oscillator for dial accuracy (coil slug at 90 MHz, trimmer capacitor at 106 MHz).
4	**RF ALIGNMENT** Preferred Method	Figure 1.	**Function:** Dual Sweep **RF Level:** 3 μV to 30 μV **Frequency:** Tune to receiver **Sweep Width:** 600 kHz **Phase:** To superimpose scope forward and reverse traces.	Same as above.	Maximum amplitude and symmetry of the scope display. Adjust coils at 90 MHz, capacitors at 106 MHz.
4A	**RF ALIGNMENT** Alternate Method	Figure 3.	**Function:** Monaural **RF Level:** 100 μV **Frequency:** Tune to receiver **Input:** Left **Osc Level:** 100% modulation	Same as above.	Sync scope on INT OSC output of 1000A. Reduce RF LEVEL below limiting. Align RF coils at 90 MHz, trimmer capacitors at 106 MHz for max audio output.
5	**FM DETECTOR ALIGNMENT** Preferred Method	Figure 2.	**Function:** Dual Sweep **RF Level:** 1000 μV **Frequency:** Tune to receiver **Sweep Width:** 250 kHz **Phase:** To superimpose scope forward and reverse traces.	**Mode:** Monaural, FM **Muting:** Off **Tuning:** To a dead spot in the fm band	Tune for symmetrical pattern with flat top. Reduce SWEEP WIDTH to zero and adjust secondary to center zero-tune meter if receiver has one. Increase SWEEP WIDTH to 250 kHz and adjust primary for optimum flatness.
5A	**FM DETECTOR ALIGNMENT** Alternate Method	Figure 3 except TAPE RCDR OUTPUT of receiver is connected to Total Harmonic Distortion Analyzer.	**Function:** Monaural **RF Level:** 1000 μV **Frequency:** Tune to receiver **Input:** Left **Osc Level:** 100% modulation	Same as above.	Adjust secondary to center zero-tune meter, if receiver has one. Adjust primary for a minimum reading on the distortion analyzer.
6	**STEREO DECODER SCA TRAP**	Figure 3 SCA test point to scope vertical.	**Function:** SCA **RF Level:** 1000 μV **Frequency:** Tune to receiver **Osc Level:** 30% modulation	**Mode:** Stereo, FM **Muting:** Off **Tuning:** To a dead spot in the fm band	Adjust for minimum 67 kHz on scope. Note: Connection to receiver must be ahead of de-emphasis circuit.
7	**STEREO DECODER 19 kHz COILS**	Figure 3. Recorder out to scope vertical.	**Function:** Stereo **RF Level:** 1000 μV **Frequency:** Tune to receiver **Pilot Level:** 8% **Input:** Left or Right **Osc Level:** 100% modulation	Same as above.	Gradually decrease pilot level while adjusting coils for max separation.
8	**STEREO DECODER 38 kHz COIL**	Same as above.	**Same as above except:** **Pilot Level:** 10% **Input:** L – R	Same as above.	Adjust for maximum amplitude of scope display.
9	**STEREO DECODER** Stereo Separation Control	Same as above.	**Same as above except:** **Input:** Left or Right	Same as above.	Adjust for maximum separation.

how to align stereo receivers

EASILY AND QUICKLY WITH THE ST MODEL 1000A FM ALIGNMENT GENERATOR



ST SOUND TECHNOLOGY

Alignment Chart

Read Detailed Alignment Procedures for additional description and tech

STEP	ADJUSTMENT PROCEDURE	SYSTEM CONNECTIONS	MODEL 1000A CONTROLS	RECEIVER CONTROLS	ALIGN FOR
1	IF ALIGNMENT Preferred Method	Figure 1.	**Function:** Dual Sweep **RF Level:** 100 μV or less **Frequency:** Tune to receiver **Sweep Width:** 600 kHz **Phase:** To superimpose scope forward and reverse traces.	**Mode:** Monaural, FM **Muting:** Off **Tuning:** To a dead spot in the fm band	Maximum amplitude and symmetry of the scope display.
1A	IF ALIGNMENT Alternate Method	Figure 3.	**Function:** Monaural **RF Level:** 100 μV or less **Frequency:** Tune to receiver **Input:** Left **Osc Level:** 100% modulation	Same as above.	Sync scope on INT OSC output of 1000A. Reduce RF level below limiting. Align for max audio output.
2	PEAK TUNING METER ADJUSTMENT	—	Same as IF alignment method used except set RF Level to 30 μV.	Same as above.	Fine tune 1000A to center of IF bandpass. Reduce SWEEP WIDTH to zero (or set OSC LEVEL to zero). Adjust for peak reading on meter.
3	LOCAL OSCILLATOR ALIGNMENT	—	Use accurate 90 MHz and 106 MHz sources.	**Mode:** Monaural, FM **Muting:** off **Tuning:** 90MHz for coil slug, 106MHz for trimmer capacitor.	Complete any mechanical dial adjustments first. Align local oscillator for dial accuracy (coil slug at 90 MHz, trimmer capacitor at 106 MHz).
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4A	RF ALIGNMENT Alternate Method	Figure 3.	**Function:** Monaural **RF Level:** 100 μV **Frequency:** Tune to receiver **Input:** Left **Osc Level:** 100% modulation	Same as above.	Sync scope on INT OSC output of 1000A. Reduce RF LEVEL below limiting. Align RF coils at 90 MHz, trimmer capacitors at 106 MHz for max audio output.
5	FM DETECTOR ALIGNMENT Preferred Method	Figure 2.	**Function:** Dual Sweep **RF Level:** 1000 μV **Frequency:** Tune to receiver **Sweep Width:** 250 kHz **Phase:** To superimpose scope forward and reverse traces.	**Mode:** Monaural, FM **Muting:** Off **Tuning:** To a dead spot in the fm band	Tune for symmetrical pattern with flat top. Reduce SWEEP WIDTH to zero and adjust secondary to center zero-tune meter if receiver has one. Increase SWEEP WIDTH to 250 kHz and adjust primary for optimum flatness.
5A	FM DETECTOR ALIGNMENT Alternate Method	Figure 3 except TAPE RCDR OUTPUT of receiver is connected to Total Harmonic Distortion Analyzer.	**Function:** Monaural **RF Level:** 1000 μV **Frequency:** Tune to receiver **Input:** Left **Osc Level:** 100% modulation	Same as above.	Adjust secondary to center zero-tune meter, if receiver has one. Adjust primary for a minimum reading on the distortion analyzer.
6	STEREO DECODER SCA TRAP	Figure 3 SCA test point to scope vertical.	**Function:** SCA **RF Level:** 1000 μV **Frequency:** Tune to receiver **Osc Level:** 30% modulation	**Mode:** Stereo, FM **Muting:** Off **Tuning:** To a dead spot in the fm band	Adjust for minimum 67 kHz on scope. Note: Connection to receiver must be ahead of de-emphasis circuit.
7	STEREO DECODER 19 kHz COILS	Figure 3. Recorder out to scope vertical.	**Function:** Stereo **RF Level:** 1000 μV **Frequency:** Tune to receiver **Pilot Level:** 8% **Input:** Left or Right **Osc Level:** 100% modulation	Same as above.	Gradually decrease pilot level while adjusting coils for max separation.
8	STEREO DECODER 38 kHz COIL	Same as above.	**Same as above except:** **Pilot Level:** 10% **Input:** L – R	Same as above.	Adjust for maximum amplitude of scope display.
9	STEREO DECODER Stereo Separation Control	Same as above.	**Same as above except:** **Input:** Left or Right	Same as above.	Adjust for maximum separation.

Detailed Alignment Procedures

GENERAL GUIDELINES

We have found the following alignment methods to be generally applicable. It should be noted, however, that some receiver circuits have special requirements. Receiver manufacturers' service manuals should be consulted whenever possible.

A Few General Rules

- You can quickly and easily determine the receiver's condition without even removing its covers. Spending a few minutes making some performance measurements before proceeding with alignment is well worthwhile. If, for example, you find the receiver has good sensitivity you can skip the RF and IF sections in your alignment. Receiver performance measurements are described on page 7 of this brochure.

- In all of the tests the Model 1000A RF output is connected to the receiver 300Ω antenna input. Use a suitable matching network such as the *Sound Technology* Model 100 Matching Transformer. When this unit is used, the generator RF LEVEL dial reads directly the microvolts applied to the receiver antenna terminals.

- Where frequencies in the fm band are specified, they should be considered to be approximate frequencies. Adjustments should be made at dead spots in the fm band to avoid the possibility of misleading results due to interference from a local fm station.

- The receiver should be set in the Monaural mode for all procedures except the stereo decoder adjustments.

- Receiver muting circuits should be disabled.

- It is best to perform the alignment in the order shown in this brochure.

IF ALIGNMENT

Preferred Method – Sweep Alignment

Sweep alignment is the preferred method for tuning a receiver's IF strip because it is fast and usually produces the best results. Sweep alignment requires probing the IF. Some receivers provide an IF test point; however, when one is not provided, a detector probe must be used to observe the bandpass or an alternate method for IF alignment must be used. Information on detector probes is available from *Sound Technology*.

Connect the probe to the receiver at the input to the amplifier driving the discriminator. The lower the impedance to ground at this point, the better. Probing a low impedance point minimizes the probe's detuning effect.

Connect the 1000A and a scope to the receiver as in Figure 1 and set the receiver and the 1000A controls as described in the Alignment Chart, Step 1. Adjust 1000A frequency dial to locate IF sweep pattern in the center of the scope trace. Adjust PHASE control to make forward and reverse traces on the scope coincide. A typical response pattern is shown in Figure 4. The pattern will be inverted in some receivers. Adjust the IF circuits for maximum amplitude and symmetry of the pattern. Vary 1000A RF LEVEL up and down to see if the pattern maintains its shape and make a compromise adjustment if necessary.

Notes

1. If the IF strip will not come into alignment or if for some reason you suspect the IF frequency is too far away from 10.7 MHz (greater than 0.5 MHz), you can inject a signal from a 10.7 MHz crystal oscillator into the IF strip and obtain a beat frequency marker as shown in Figure 4. Inject the 10.7 MHz marker signal near the mixer stage and adjust the 1000A frequency to center the marker on the scope trace. Then remove the 10.7 MHz and turn off the crystal oscillator so it won't interfere with the alignment. Information on crystal oscillators is available from *Sound Technology*.

2. Some receivers will have fixed-tuned IF's. IF alignment is unnecessary in such a case, of course, but the discriminator and peak-tuning meter (if there is a separate adjustment) must be aligned to the fixed IF center frequency, as described later under FM Detector Alignment.

Alternate Method 1 – Monaural Alignment

Connect the equipment as shown in Figure 3. Set the receiver and 1000A controls as described in the Alignment Chart, Step 1A. A scope is used to observe audio output from the receiver. An AC (audio) voltmeter can also be used.

Reduce 1000A RF LEVEL until the audio on the scope drops approximately 20% in amplitude. The receiver is now operating below limiting.

Fine tune the 1000A for maximum audio and adjust the IF circuits to peak the audio on the scope. If you run into limiting, reduce RF LEVEL again.

Alternate Method 2 – Alignment by Peak-Tuning Meter

Set the equipment up as described in Alternate Method 1. First tune the 1000A for a peak on the meter, making sure the RF LEVEL is low enough to get a sensitive peak, probably below 30 μV, then align the IF strip for a peak meter reading. If the receiver has a peak-tuning meter adjustment, it should be aligned together with the IF's.

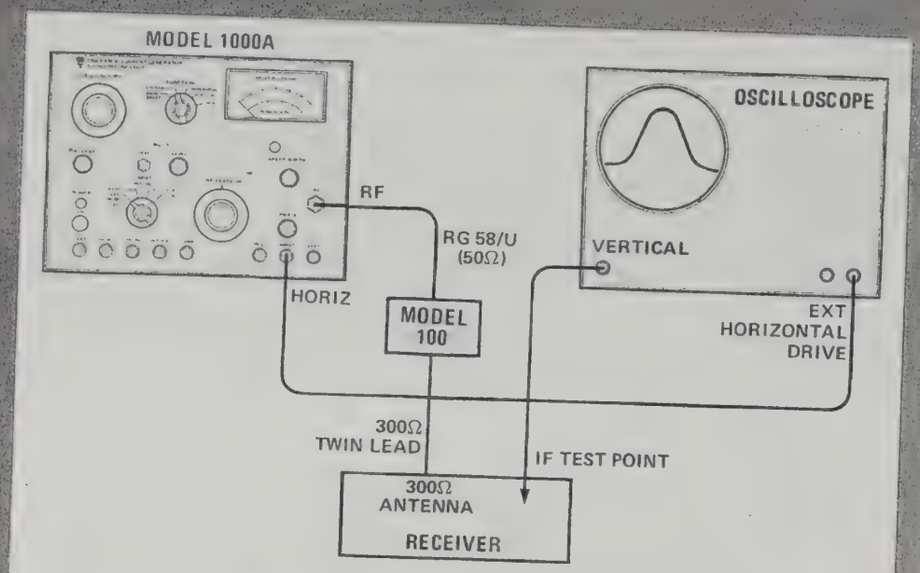


Figure 1. RF and IF Sweep Alignment

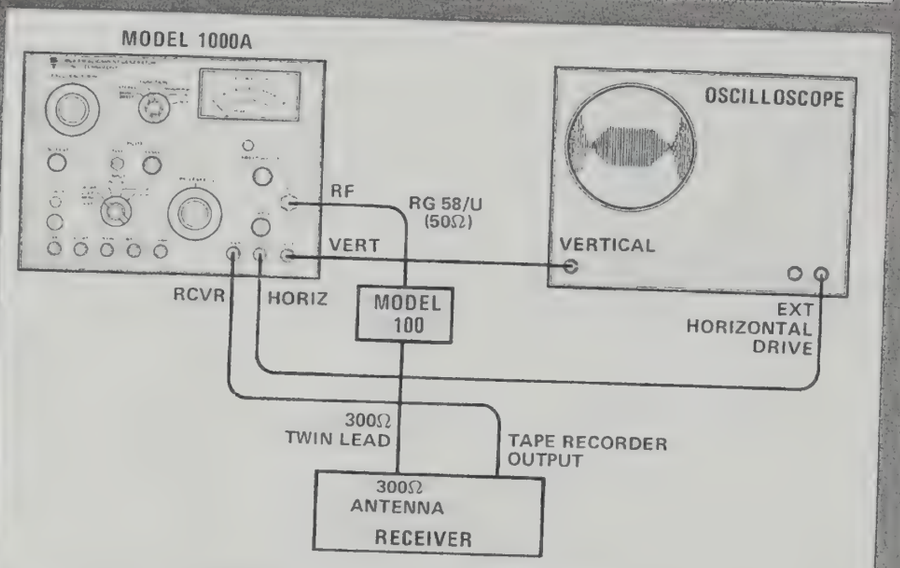


Figure 2. Discriminator Alignment

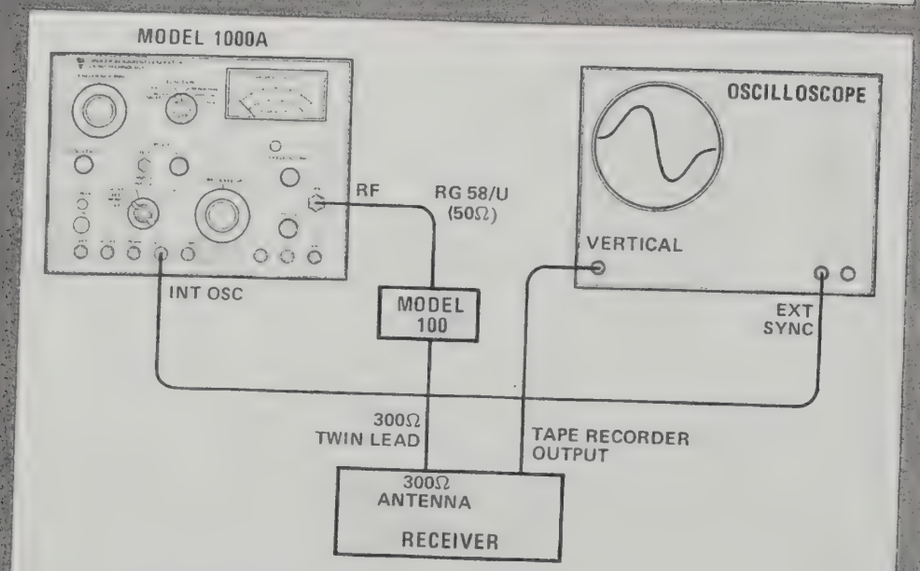


Figure 3. Alternate RF, IF and Detector Alignment
Stereo Decoder Alignment

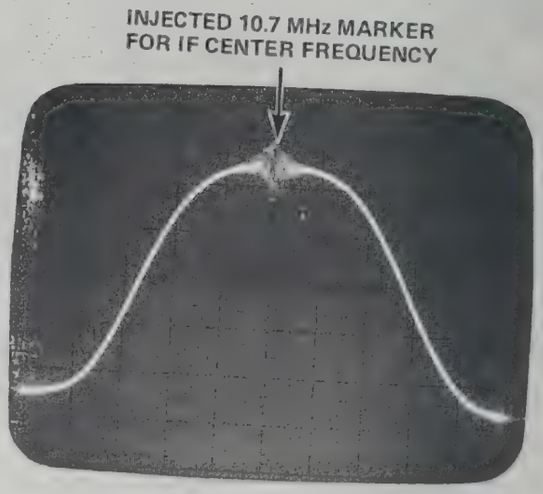


Figure 4.
RF and IF Response

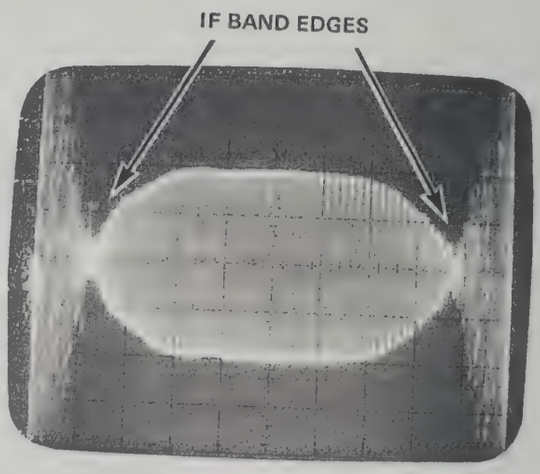


Figure 5.
Dual Sweep Response (Detector Alignment)

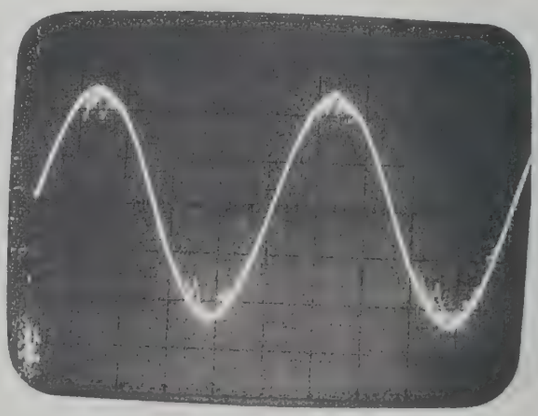


Figure 6.
Three Percent Distortion and Noise

Detailed Alignment Procedures

GENERAL GUIDELINES

We have found the following alignment methods to be generally applicable. It should be noted, however, that some receiver circuits have special requirements. Receiver manufacturers' service manuals should be consulted whenever possible.

A Few General Rules

- You can quickly and easily determine the receiver's condition without even removing its covers. Spending a few minutes making some performance measurements before proceeding with alignment is well worthwhile. If, for example, you find the receiver has good sensitivity you can skip the RF and IF sections in your alignment. Receiver performance measurements are described on page 7 of this brochure.

- In all of the tests the Model 1000A RF output is connected to the receiver 300Ω antenna input. Use a suitable matching network such as the *Sound Technology* Model 100 Matching Transformer. When this unit is used, the generator RF LEVEL dial reads directly the microvolts applied to the receiver antenna terminals.

- Where frequencies in the fm band are specified, they should be considered to be approximate frequencies. Adjustments should be made at dead spots in the fm band to avoid the possibility of misleading results due to interference from a local fm station.

- The receiver should be set in the Monaural mode for all procedures except the stereo decoder adjustments.

- Receiver muting circuits should be disabled.

- It is best to perform the alignment in the order shown in this brochure.

IF ALIGNMENT

Preferred Method – Sweep Alignment

Sweep alignment is the preferred method for tuning a receiver's IF strip because it is fast and usually produces the best results. Sweep alignment requires probing the IF. Some receivers provide an IF test point; however, when one is not provided, a detector probe must be used to observe the bandpass or an alternate method for IF alignment must be used. Information on detector probes is available from *Sound Technology*.

Connect the probe to the receiver at the input to the amplifier driving the discriminator. The lower the impedance to ground at this point, the better. Probing a low impedance point minimizes the probe's detuning effect.

Connect the 1000A and a scope to the receiver as in Figure 1 and set the receiver and the 1000A controls as described in the Alignment Chart, Step 1. Adjust 1000A frequency dial to locate IF sweep pattern in the center of the scope trace. Adjust PHASE control to make forward and reverse traces on the scope coincide. A typical response pattern is shown in Figure 4. The pattern will be inverted in some receivers. Adjust the IF circuits for maximum amplitude and symmetry of the pattern. Vary 1000A RF LEVEL up and down to see if the pattern maintains its shape and make a compromise adjustment if necessary.

Notes

1. If the IF strip will not come into alignment or if for some reason you suspect the IF frequency is too far away from 10.7 MHz (greater than 0.5 MHz), you can inject a signal from a 10.7 MHz crystal oscillator into the IF strip and obtain a beat frequency marker as shown in Figure 4. Inject the 10.7 MHz marker signal near the mixer stage and adjust the 1000A frequency to center the marker on the scope trace. Then remove the 10.7 MHz and turn off the crystal oscillator so it won't interfere with the alignment. Information on crystal oscillators is available from *Sound Technology*.

2. Some receivers will have fixed-tuned IF's. IF alignment is unnecessary in such a case, of course, but the discriminator and peak-tuning meter (if there is a separate adjustment) must be aligned to the fixed IF center frequency, as described later under FM Detector Alignment.

Alternate Method 1 – Monaural Alignment

Connect the equipment as shown in Figure 3. Set the receiver and 1000A controls as described in the Alignment Chart, Step 1A. A scope is used to observe audio output from the receiver. An AC (audio) voltmeter can also be used.

Reduce 1000A RF LEVEL until the audio on the scope drops approximately 20% in amplitude. The receiver is now operating below limiting.

Fine tune the 1000A for maximum audio and adjust the IF circuits to peak the audio on the scope. If you run into limiting, reduce RF LEVEL again.

Alternate Method 2 – Alignment by Peak-Tuning Meter

Set the equipment up as described in Alternate Method 1. First tune the 1000A for a peak on the meter, making sure the RF LEVEL is low enough to get a sensitive peak, probably below 30 μV, then align the IF strip for a peak meter reading. If the receiver has a peak-tuning meter adjustment, it should be aligned together with the IF's.

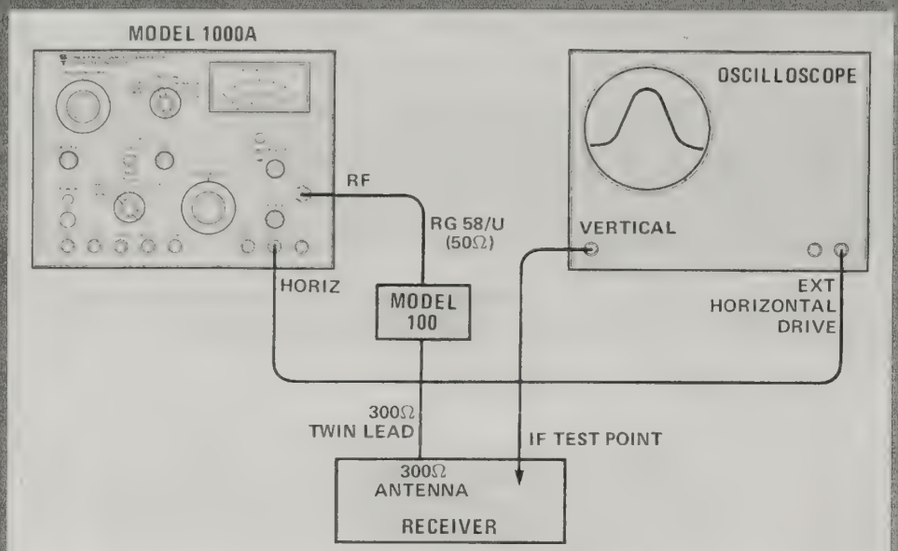


Figure 1. RF and IF Sweep Alignment

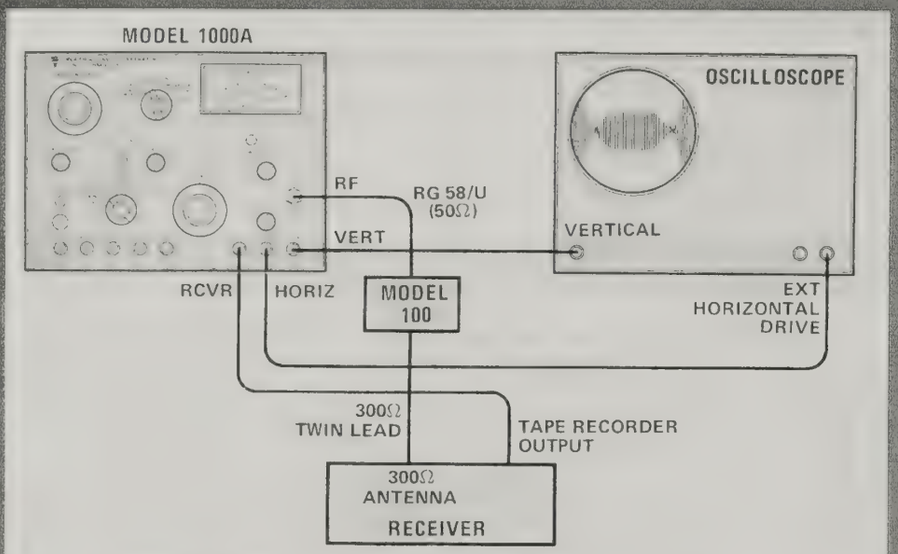


Figure 2. Discriminator Alignment

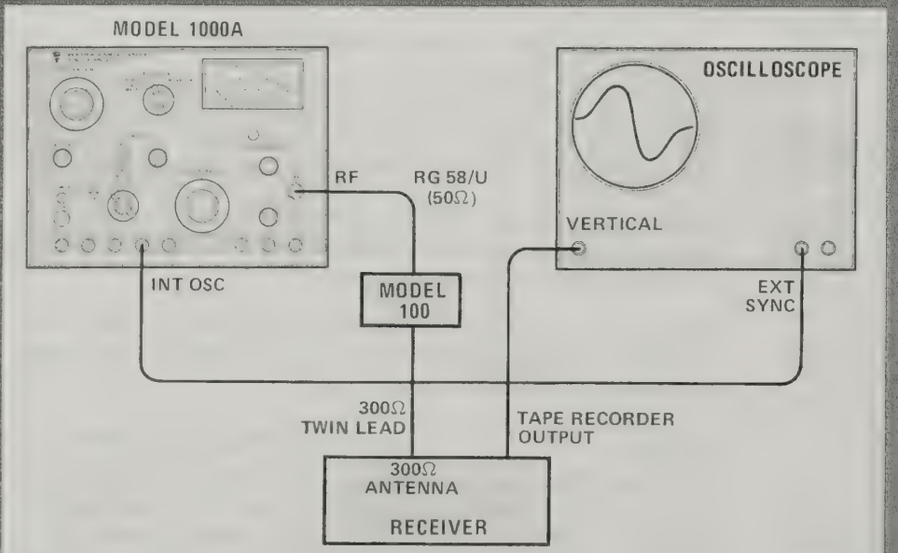


Figure 3. Alternate RF, IF and Detector Alignment
Stereo Decoder Alignment

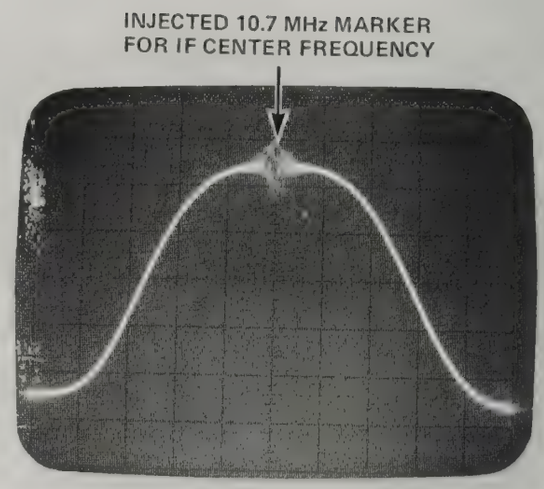


Figure 4.
RF and IF Response

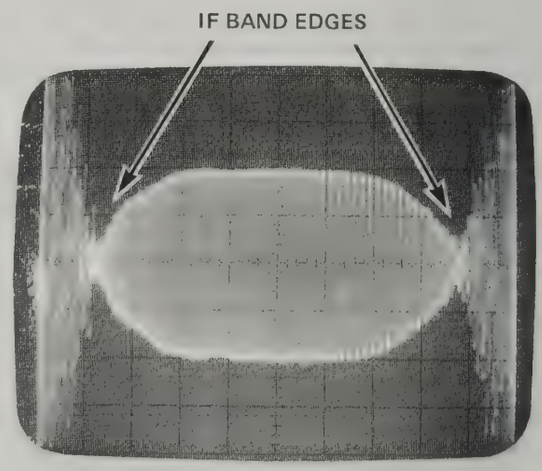


Figure 5.
Dual Sweep Response (Detector Alignment)

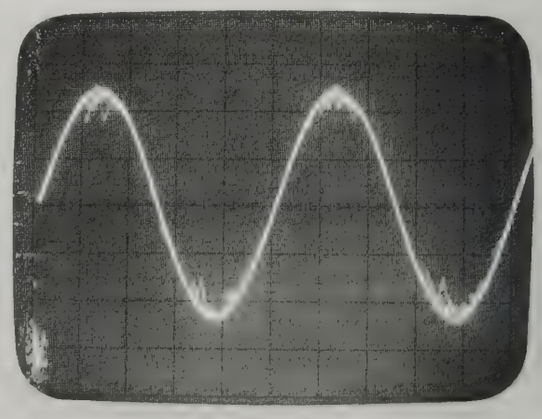


Figure 6.
Three Percent Distortion and Noise

Detailed Alignment Procedures

GENERAL GUIDELINES

We have found the following alignment methods to be generally applicable. It should be noted, however, that some receiver circuits have special requirements. Receiver manufacturers' service manuals should be consulted whenever possible.

A Few General Rules

- You can quickly and easily determine the receiver's condition without even removing its covers. Spending a few minutes making some performance measurements before proceeding with alignment is well worthwhile. If, for example, you find the receiver has good sensitivity you can skip the RF and IF sections in your alignment. Receiver performance measurements are described on page 7 of this brochure.

- In all of the tests the Model 1000A RF output is connected to the receiver 300Ω antenna input. Use a suitable matching network such as the *Sound Technology* Model 100 Matching Transformer. When this unit is used, the generator RF LEVEL dial reads directly the microvolts applied to the receiver antenna terminals.

- Where frequencies in the fm band are specified, they should be considered to be approximate frequencies. Adjustments should be made at dead spots in the fm band to avoid the possibility of misleading results due to interference from a local fm station.

- The receiver should be set in the Monaural mode for all procedures except the stereo decoder adjustments.

- Receiver muting circuits should be disabled.

- It is best to perform the alignment in the order shown in this brochure.

IF ALIGNMENT

Preferred Method – Sweep Alignment

Sweep alignment is the preferred method for tuning a receiver's IF strip because it is fast and usually produces the best results. Sweep alignment requires probing the IF. Some receivers provide an IF test point; however, when one is not provided, a detector probe must be used to observe the bandpass or an alternate method for IF alignment must be used. Information on detector probes is available from *Sound Technology*.

Connect the probe to the receiver at the input to the amplifier driving the discriminator. The lower the impedance to ground at this point, the better. Probing a low impedance point minimizes the probe's detuning effect.

Connect the 1000A and a scope to the receiver as in Figure 1 and set the receiver and the 1000A controls as described in the Alignment Chart, Step 1. Adjust 1000A frequency dial to locate IF sweep pattern in the center of the scope trace. Adjust PHASE control to make forward and reverse traces on the scope coincide. A typical response pattern is shown in Figure 4. The pattern will be inverted in some receivers. Adjust the IF circuits for maximum amplitude and symmetry of the pattern. Vary 1000A RF LEVEL up and down to see if the pattern maintains its shape and make a compromise adjustment if necessary.

Notes

1. If the IF strip will not come into alignment or if for some reason you suspect the IF frequency is too far away from 10.7 MHz (greater than 0.5 MHz), you can inject a signal from a 10.7 MHz crystal oscillator into the IF strip and obtain a beat frequency marker as shown in Figure 4. Inject the 10.7 MHz marker signal near the mixer stage and adjust the 1000A frequency to center the marker on the scope trace. Then remove the 10.7 MHz and turn off the crystal oscillator so it won't interfere with the alignment. Information on crystal oscillators is available from *Sound Technology*.

2. Some receivers will have fixed-tuned IF's. IF alignment is unnecessary in such a case, of course, but the discriminator and peak-tuning meter (if there is a separate adjustment) must be aligned to the fixed IF center frequency, as described later under FM Detector Alignment.

Alternate Method 1 – Monaural Alignment

Connect the equipment as shown in Figure 3. Set the receiver and 1000A controls as described in the Alignment Chart, Step 1A. A scope is used to observe audio output from the receiver. An AC (audio) voltmeter can also be used.

Reduce 1000A RF LEVEL until the audio on the scope drops approximately 20% in amplitude. The receiver is now operating below limiting.

Fine tune the 1000A for maximum audio and adjust the IF circuits to peak the audio on the scope. If you run into limiting, reduce RF LEVEL again.

Alternate Method 2 – Alignment by Peak-Tuning Meter

Set the equipment up as described in Alternate Method 1. First tune the 1000A for a peak on the meter, making sure the RF LEVEL is low enough to get a sensitive peak, probably below 30 μV, then align the IF strip for a peak meter reading. If the receiver has a peak-tuning meter adjustment, it should be aligned together with the IF's.

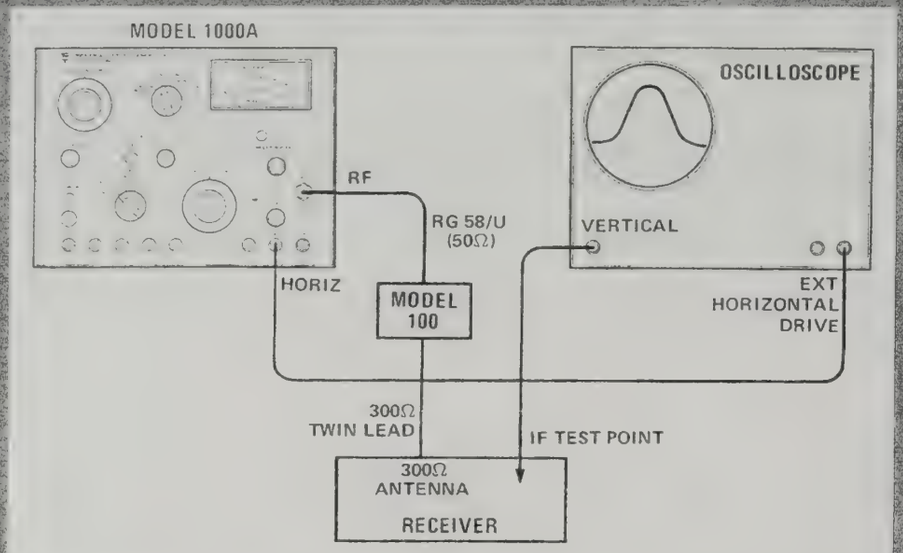


Figure 1. RF and IF Sweep Alignment

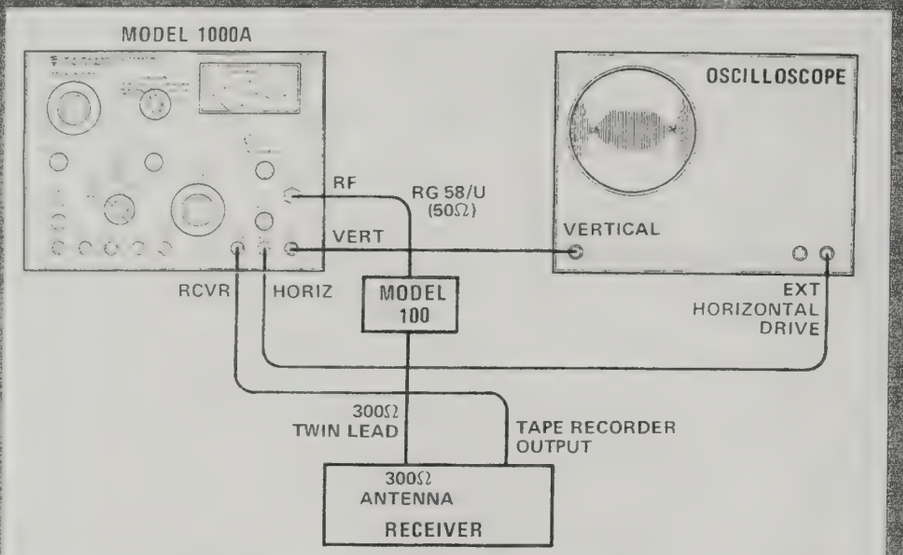


Figure 2. Discriminator Alignment

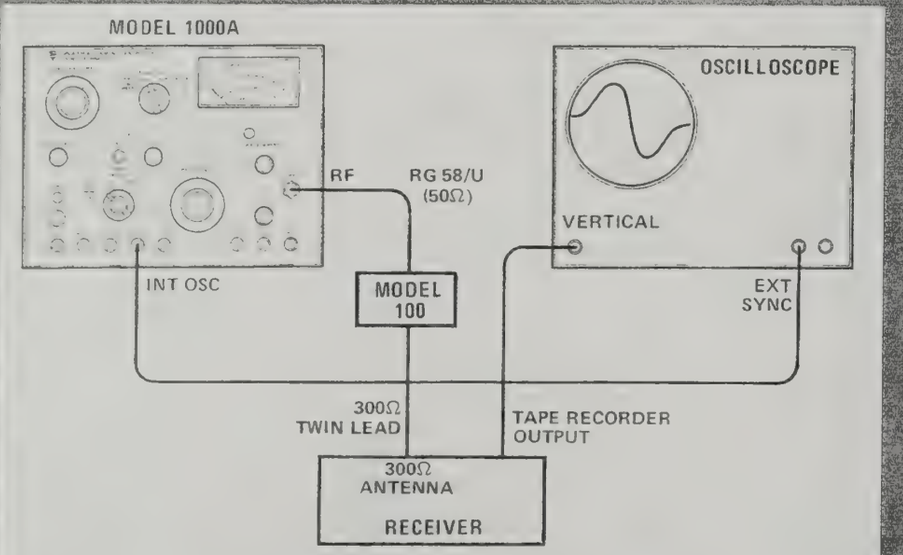


Figure 3. Alternate RF, IF and Detector Alignment
Stereo Decoder Alignment

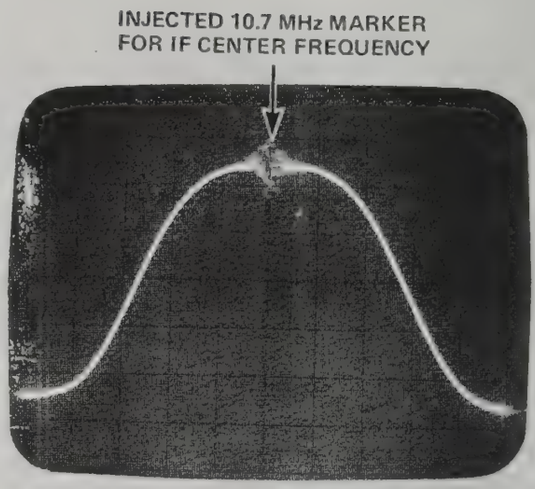


Figure 4.
RF and IF Response

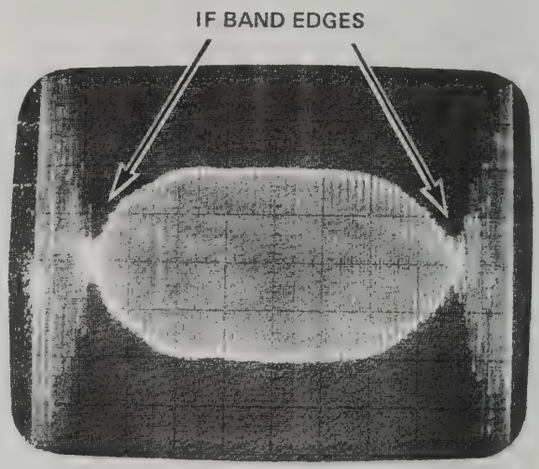


Figure 5.
Dual Sweep Response (Detector Alignment)

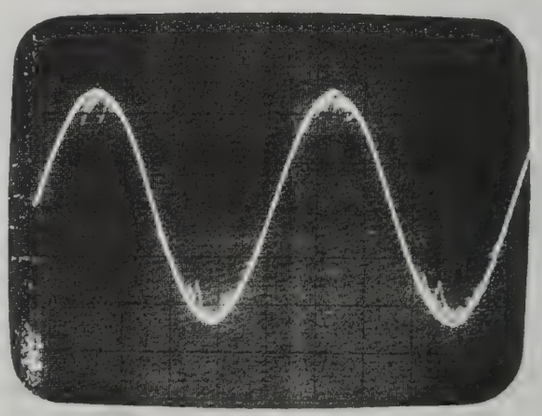
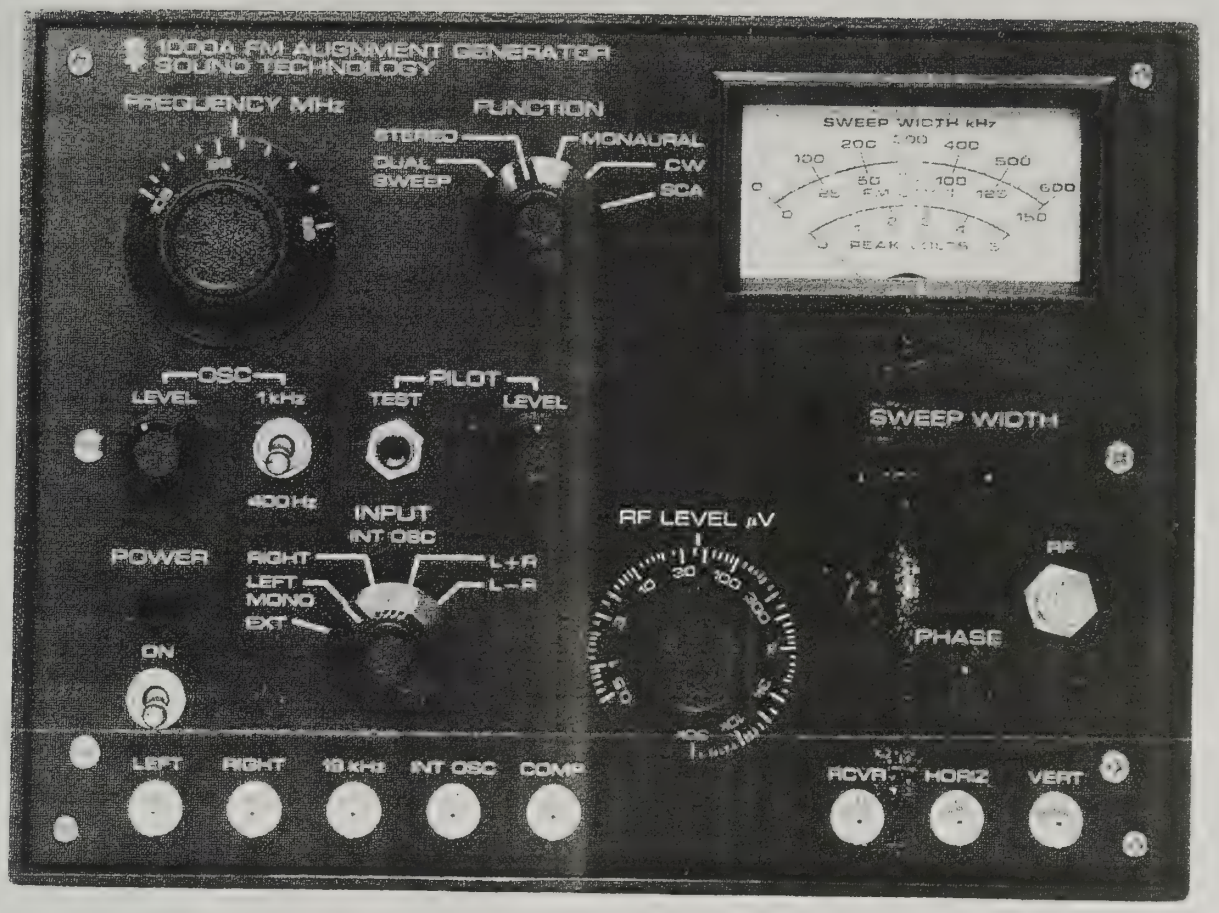


Figure 6.
Three Percent Distortion and Noise



PEAK-TUNING METER ADJUSTMENT

If the receiver has a separate tuned circuit for the peak-tuning meter, immediately after IF alignment and without changing receiver or 1000A frequency, align the tuned circuit for a peak meter reading. If the IF's were aligned by the sweep method, reduce SWEEP WIDTH to zero before doing the alignment. RF LEVEL is set below 30 μV. If there is a gain adjustment on the meter circuit, set full scale at 10mV RF LEVEL unless manufacturer's instructions specify otherwise.

If the receiver has fixed-tuned IF's proceed to FM Detector Alignment before adjusting the peak-tuning meter. After adjusting the detector, reduce SWEEP WIDTH to zero and adjust the peak-tuning meter circuits.

LOCAL OSCILLATOR ALIGNMENT FOR RECEIVER DIAL ACCURACY

Correct any slippage in the dial mechanism and, using a local station or crystal oscillator, tune the receiver to a signal source of known frequency near 90 MHz. Adjust the local oscillator coil for an accurate receiver dial reading.

Repeat near 106 MHz. Tune local oscillator trimmer capacitor for an accurate dial reading.

Repeat these steps until effects of high and low end interaction are eliminated. Information on dial calibration standards is available from *Sound Technology*.

RF ALIGNMENT

Preferred Method – Sweep Alignment

Connect equipment as in Figure 1, and set the receiver and 1000A controls as described in the Alignment Chart, Step 4. With the receiver and generator set near 90 MHz, adjust all the rf (excluding local oscillator) coils for maximum amplitude and symmetry of the scope display. If maximum amplitude does not coincide with optimum symmetry it may be necessary to go back and touch up the IF circuits.

With the receiver and generator set near 106 MHz, adjust the rf trimmer capacitors for maximum amplitude and symmetry of the scope display.

Repeat these steps to eliminate the effects of interaction.

Alternate Method – Monaural Alignment

Connect equipment as in Figure 3, and set the receiver and 1000A controls as described in the Alignment Chart, Step 4A. Tune 1000A FREQUENCY and receiver to 90 MHz to obtain an audio waveform as in IF Alignment, Alternate Method 1. Reduce RF LEVEL below limiting and adjust coils in tuner (except local oscillator) to maximize the amplitude of the scope waveform.

Repeat at 106 MHz and adjust the tuner's trimmer capacitors.

Repeat these steps until interaction is eliminated.

FM DETECTOR (DISCRIMINATOR) ALIGNMENT

Preferred Method – Dual Sweep Alignment

Connect the equipment as shown in Figure 2, and set the 1000A and receiver controls as described in the Alignment Chart, Step 5. Tune the 1000A to obtain the scope pattern shown in Figure 5.

An ideal receiver will display a DUAL SWEEP pattern with a rectangular center portion. The bandwidth of the flat portion of the top should be at least 250 kHz. Align discriminator primary and secondary to approach this ideal as nearly as possible. Use a wide SWEEP WIDTH to optimize the symmetry of the receiver's band edges and get an overall picture of the receiver's performance. The center portion of the display drops to zero at the IF band edges. A wide, symmetrical pattern means the receiver will be easy to tune. Set sweep width to 250 kHz to make final primary (usually the bottom slug) adjustments to optimize flatness of display. Vary RF LEVEL up and down to see if the pattern maintains its shape. Make a compromise adjustment if necessary.

Notes

1. Receiver distortion can be calculated directly from the DUAL SWEEP display as follows:

Set SWEEP WIDTH to 150 kHz and calculate distortion as follows:

Peak I.M. Distortion =

$$\frac{\text{Peak-to-peak variation of the pattern top}}{\text{Average peak-to-peak pattern height}} \times 100\%$$

$$\text{Total Harmonic Distortion} = \frac{\text{Peak I.M. Distortion}}{5} (\pm 25\%)$$

2. Any sharp spikes in the bandpass are probably due to an oscillating IF stage, the stereo decoder (put the receiver in mono), or interference from a local station.

3. If the display drops suddenly to zero near the band edges, it is probably an audio stage clipping. This may not be significant, since we are sweeping the receiver over a wider band than it must normally handle. Narrowing SWEEP WIDTH should avoid this effect.

4. For receivers with fixed-tuned IF's, adjust the 1000A FREQUENCY so the IF center frequency corresponds with the center of the scope sweep display. The DUAL SWEEP pattern will fall to zero at the edges of the IF bandpass (Figure 5). Fine tune the 1000A until the middle portion of the DUAL SWEEP pattern is centered on the scope. Leave the 1000A tuned to this frequency while adjusting the discriminator and peak-tuning meter. If the discriminator is badly misaligned, some preliminary adjustment may be required while finding the IF center frequency.

5. For receivers with a zero-center-tuning meter, fine tune 1000A for the IF band center, as in note 4 above. Reduce SWEEP WIDTH to zero. Adjust discriminator secondary to zero the zero-center-tuning meter or to obtain zero volts at manufacturer's specified discriminator output test point. Set SWEEP WIDTH to 250 kHz, and adjust discriminator primary (usually the bottom slug) for optimum flatness of the DUAL SWEEP pattern.

Alternate Method – Monaural Alignment

In this method, the alignment is done while observing distortion of the receiver's audio output on a Distortion Analyzer rather than using DUAL SWEEP. The set-up is covered in the Alignment Chart, Step 5A. This method can lead to erroneous results because the alignment does not take into consideration what is happening on the band edges. The receiver may not respond well to modulation peaks and may be difficult to tune because of an unnecessarily abrupt change in linearity at one or both of the band edges. Keep in mind, also, that the alignment can be no better than the distortion of the generator being used. A low reading on the Distortion Analyzer means that the receiver has been aligned to have distortion equal to that of the generator, but with opposite phase. The 1000A has less than 0.1% distortion. If a generator with 1% distortion is used, a "perfect" alignment will result in the receiver having 1% distortion.

STEREO DECODER ALIGNMENT

Connect the equipment as shown in Figure 3. Set the 1000A and receiver controls as described in the Alignment Chart, Step 6.

SCA Trap

Connect the scope to a test point in the stereo demodulator between the SCA trap and the de-emphasis circuits. If a test point is not designated by the manufacturer, connect to the secondary of the 38 kHz transformer. Use a low capacitance probe. Adjust the SCA trap for minimum 67 kHz on the scope.

Note

Some manufacturers may have other SCA adjustments at fixed frequencies. In this case switch the 1000A to MONAURAL with the INPUT switch on EXT. Connect an external audio oscillator to the 1000A LEFT input and adjust the oscillator output for approximately 30% modulation. Then make the adjustments prescribed by the receiver manufacturer.

19 kHz Coils

Set up 1000A and receiver as described in the Alignment Chart, Step 7. There are two methods for aligning the 19 kHz coils. In this first method the 1000A PILOT LEVEL is gradually lowered while continuing to adjust for maximum separation as observed on the scope. Most receivers work down to 5% pilot. Be sure the left and right channels are not reversed while making this adjustment.

The second method requires connecting the vertical input of the scope to a test point in the receiver at the output of the final 19 kHz amplifier. The coils are then adjusted for maximum output of the 19 kHz.

38 kHz Coils

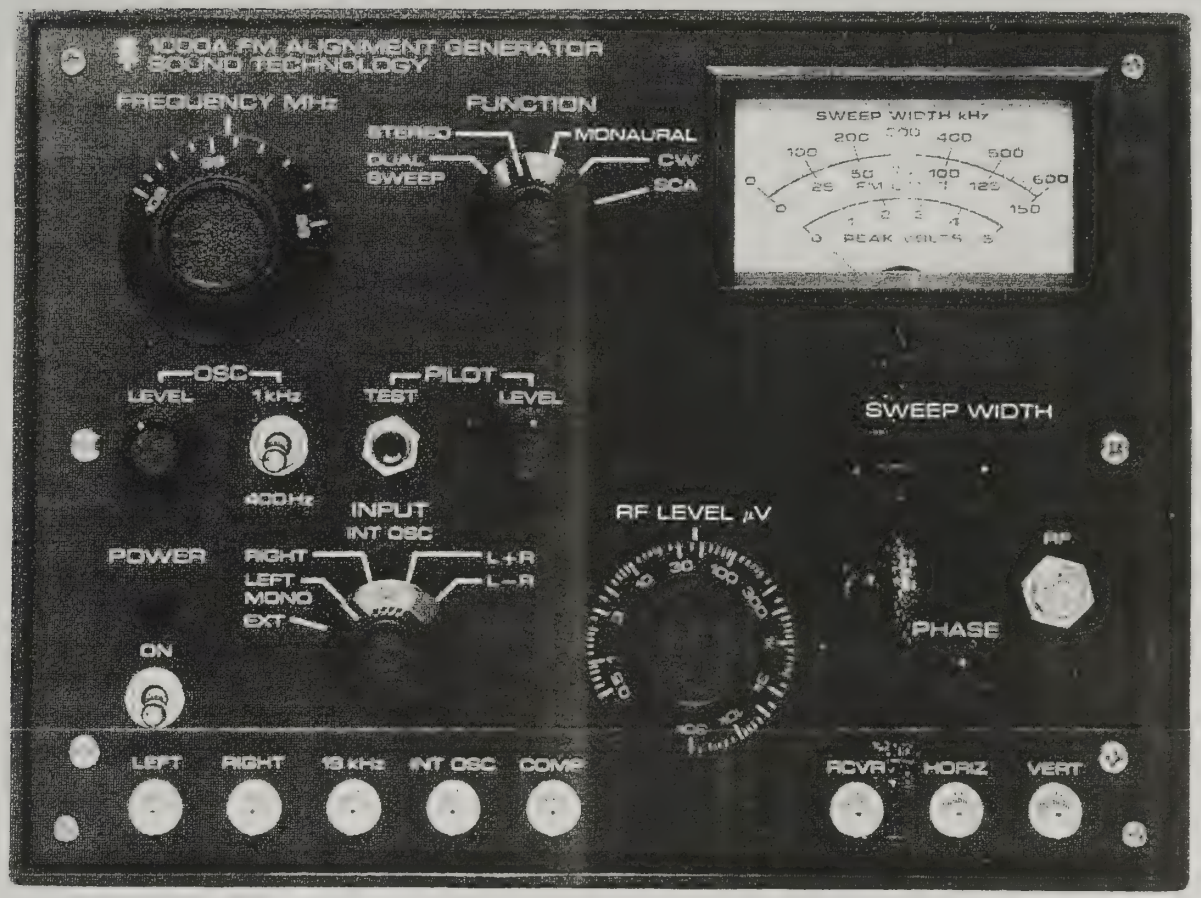
With 1000A and receiver settings as described in the Alignment Chart, Step 8, adjust the 38 kHz transformer for maximum audio output on the scope display. This adjustment provides minimum distortion and is not dependent on the setting of the receiver's Stereo Separation Control.

Stereo Separation Control

Adjust the receiver's separation control for maximum separation. A compromise adjustment may be required if left-to-right and right-to-left separations are unequal.

Note

If you go back and adjust 19 or 38 kHz coils to improve separation, you will introduce audio distortion.



PEAK-TUNING METER ADJUSTMENT

If the receiver has a separate tuned circuit for the peak-tuning meter, immediately after IF alignment and without changing receiver or 1000A frequency, align the tuned circuit for a peak meter reading. If the IF's were aligned by the sweep method, reduce SWEEP WIDTH to zero before doing the alignment. RF LEVEL is set below 30 μV. If there is a gain adjustment on the meter circuit, set full scale at 10mV RF LEVEL unless manufacturer's instructions specify otherwise.

If the receiver has fixed-tuned IF's proceed to FM Detector Alignment before adjusting the peak-tuning meter. After adjusting the detector, reduce SWEEP WIDTH to zero and adjust the peak-tuning meter circuits.

LOCAL OSCILLATOR ALIGNMENT FOR RECEIVER DIAL ACCURACY

Correct any slippage in the dial mechanism and, using a local station or crystal oscillator, tune the receiver to a signal source of known frequency near 90 MHz. Adjust the local oscillator coil for an accurate receiver dial reading.

Repeat near 106 MHz. Tune local oscillator trimmer capacitor for an accurate dial reading.

Repeat these steps until effects of high and low end interaction are eliminated. Information on dial calibration standards is available from *Sound Technology*.

RF ALIGNMENT

Preferred Method – Sweep Alignment

Connect equipment as in Figure 1, and set the receiver and 1000A controls as described in the Alignment Chart, Step 4. With the receiver and generator set near 90 MHz, adjust all the rf (excluding local oscillator) coils for maximum amplitude and symmetry of the scope display. If maximum amplitude does not coincide with optimum symmetry it may be necessary to go back and touch up the IF circuits.

With the receiver and generator set near 106 MHz, adjust the rf trimmer capacitors for maximum amplitude and symmetry of the scope display.

Repeat these steps to eliminate the effects of interaction.

Alternate Method – Monaural Alignment

Connect equipment as in Figure 3, and set the receiver and 1000A controls as described in the Alignment Chart, Step 4A. Tune 1000A FREQUENCY and receiver to 90 MHz to obtain an audio waveform as in IF Alignment, Alternate Method 1. Reduce RF LEVEL below limiting and adjust coils in tuner (except local oscillator) to maximize the amplitude of the scope waveform.

Repeat at 106 MHz and adjust the tuner's trimmer capacitors.

Repeat these steps until interaction is eliminated.

FM DETECTOR (DISCRIMINATOR) ALIGNMENT

Preferred Method – Dual Sweep Alignment

Connect the equipment as shown in Figure 2, and set the 1000A and receiver controls as described in the Alignment Chart, Step 5. Tune the 1000A to obtain the scope pattern shown in Figure 5.

An ideal receiver will display a DUAL SWEEP pattern with a rectangular center portion. The bandwidth of the flat portion of the top should be at least 250 kHz. Align discriminator primary and secondary to approach this ideal as nearly as possible. Use a wide SWEEP WIDTH to optimize the symmetry of the receiver's band edges and get an overall picture of the receiver's performance. The center portion of the display drops to zero at the IF band edges. A wide, symmetrical pattern means the receiver will be easy to tune. Set sweep width to 250 kHz to make final primary (usually the bottom slug) adjustments to optimize flatness of display. Vary RF LEVEL up and down to see if the pattern maintains its shape. Make a compromise adjustment if necessary.

Notes

1. Receiver distortion can be calculated directly from the DUAL SWEEP display as follows:

Set SWEEP WIDTH to 150 kHz and calculate distortion as follows:

Peak I.M. Distortion =

$$\frac{\text{Peak-to-peak variation of the pattern top}}{\text{Average peak-to-peak pattern height}} \times 100\%$$

$$\text{Total Harmonic Distortion} = \frac{\text{Peak I.M. Distortion}}{5} \ (\pm 25\%)$$

2. Any sharp spikes in the bandpass are probably due to an oscillating IF stage, the stereo decoder (put the receiver in mono), or interference from a local station.

3. If the display drops suddenly to zero near the band edges, it is probably an audio stage clipping. This may not be significant, since we are sweeping the receiver over a wider band than it must normally handle. Narrowing SWEEP WIDTH should avoid this effect.

4. For receivers with fixed-tuned IF's, adjust the 1000A FREQUENCY so the IF center frequency corresponds with the center of the scope sweep display. The DUAL SWEEP pattern will fall to zero at the edges of the IF bandpass (Figure 5). Fine tune the 1000A until the middle portion of the DUAL SWEEP pattern is centered on the scope. Leave the 1000A tuned to this frequency while adjusting the discriminator and peak-tuning meter. If the discriminator is badly misaligned, some preliminary adjustment may be required while finding the IF center frequency.

5. For receivers with a zero-center-tuning meter, fine tune 1000A for the IF band center, as in note 4 above. Reduce SWEEP WIDTH to zero. Adjust discriminator secondary to zero the zero-center-tuning meter or to obtain zero volts at manufacturer's specified discriminator output test point. Set SWEEP WIDTH to 250 kHz, and adjust discriminator primary (usually the bottom slug) for optimum flatness of the DUAL SWEEP pattern.

Alternate Method – Monaural Alignment

In this method, the alignment is done while observing distortion of the receiver's audio output on a Distortion Analyzer rather than using DUAL SWEEP. The set-up is covered in the Alignment Chart, Step 5A. This method can lead to erroneous results because the alignment does not take into consideration what is happening on the band edges. The receiver may not respond well to modulation peaks and may be difficult to tune because of an unnecessarily abrupt change in linearity at one or both of the band edges. Keep in mind, also, that the alignment can be no better than the distortion of the generator being used. A low reading on the Distortion Analyzer means that the receiver has been aligned to have distortion equal to that of the generator, but with opposite phase. The 1000A has less than 0.1% distortion. If a generator with 1% distortion is used, a "perfect" alignment will result in the receiver having 1% distortion.

STEREO DECODER ALIGNMENT

Connect the equipment as shown in Figure 3. Set the 1000A and receiver controls as described in the Alignment Chart, Step 6.

SCA Trap

Connect the scope to a test point in the stereo demodulator between the SCA trap and the de-emphasis circuits. If a test point is not designated by the manufacturer, connect to the secondary of the 38 kHz transformer. Use a low capacitance probe. Adjust the SCA trap for minimum 67 kHz on the scope.

Note

Some manufacturers may have other SCA adjustments at fixed frequencies. In this case switch the 1000A to MONAURAL with the INPUT switch on EXT. Connect an external audio oscillator to the 1000A LEFT input and adjust the oscillator output for approximately 30% modulation. Then make the adjustments prescribed by the receiver manufacturer.

19 kHz Coils

Set up 1000A and receiver as described in the Alignment Chart, Step 7. There are two methods for aligning the 19 kHz coils. In this first method the 1000A PILOT LEVEL is gradually lowered while continuing to adjust for maximum separation as observed on the scope. Most receivers work down to 5% pilot. Be sure the left and right channels are not reversed while making this adjustment.

The second method requires connecting the vertical input of the scope to a test point in the receiver at the output of the final 19 kHz amplifier. The coils are then adjusted for maximum output of the 19 kHz.

38 kHz Coils

With 1000A and receiver settings as described in the Alignment Chart, Step 8, adjust the 38 kHz transformer for maximum audio output on the scope display. This adjustment provides minimum distortion and is not dependent on the setting of the receiver's Stereo Separation Control.

Stereo Separation Control

Adjust the receiver's separation control for maximum separation. A compromise adjustment may be required if left-to-right and right-to-left separations are unequal.

Note

If you go back and adjust 19 or 38 kHz coils to improve separation, you will introduce audio distortion.

PEAK-TUNING METER ADJUSTMENT

If the receiver has a separate tuned circuit for the peak-tuning meter, immediately after IF alignment and without changing receiver or 1000A frequency, align the tuned circuit for a peak meter reading. If the IF's were aligned by the sweep method, reduce SWEEP WIDTH to zero before doing the alignment. RF LEVEL is set below 30 μV. If there is a gain adjustment on the meter circuit, set full scale at 10mV RF LEVEL unless manufacturer's instructions specify otherwise.

If the receiver has fixed-tuned IF's proceed to FM Detector Alignment before adjusting the peak-tuning meter. After adjusting the detector, reduce SWEEP WIDTH to zero and adjust the peak-tuning meter circuits.

LOCAL OSCILLATOR ALIGNMENT FOR RECEIVER DIAL ACCURACY

Correct any slippage in the dial mechanism and, using a local station or crystal oscillator, tune the receiver to a signal source of known frequency near 90 MHz. Adjust the local oscillator coil for an accurate receiver dial reading.

Repeat near 106 MHz. Tune local oscillator trimmer capacitor for an accurate dial reading.

Repeat these steps until effects of high and low end interaction are eliminated. Information on dial calibration standards is available from *Sound Technology*.

RF ALIGNMENT

Preferred Method – Sweep Alignment

Connect equipment as in Figure 1, and set the receiver and 1000A controls as described in the Alignment Chart, Step 4. With the receiver and generator set near 90 MHz, adjust all the rf (excluding local oscillator) coils for maximum amplitude and symmetry of the scope display. If maximum amplitude does not coincide with optimum symmetry it may be necessary to go back and touch up the IF circuits.

With the receiver and generator set near 106 MHz, adjust the rf trimmer capacitors for maximum amplitude and symmetry of the scope display.

Repeat these steps to eliminate the effects of interaction.

Alternate Method – Monaural Alignment

Connect equipment as in Figure 3, and set the receiver and 1000A controls as described in the Alignment Chart, Step 4A. Tune 1000A FREQUENCY and receiver to 90 MHz to obtain an audio waveform as in IF Alignment, Alternate Method 1. Reduce RF LEVEL below limiting and adjust coils in tuner (except local oscillator) to maximize the amplitude of the scope waveform.

Repeat at 106 MHz and adjust the tuner's trimmer capacitors.

Repeat these steps until interaction is eliminated.

FM DETECTOR (DISCRIMINATOR) ALIGNMENT

Preferred Method — Dual Sweep Alignment

Connect the equipment as shown in Figure 2, and set the 1000A and receiver controls as described in the Alignment Chart, Step 5. Tune the 1000A to obtain the scope pattern shown in Figure 5.

An ideal receiver will display a DUAL SWEEP pattern with a rectangular center portion. The bandwidth of the flat portion of the top should be at least 250 kHz. Align discriminator primary and secondary to approach this ideal as nearly as possible. Use a wide SWEEP WIDTH to optimize the symmetry of the receiver's band edges and get an overall picture of the receiver's performance. The center portion of the display drops to zero at the IF band edges. A wide, symmetrical pattern means the receiver will be easy to tune. Set sweep width to 250 kHz to make final primary (usually the bottom slug) adjustments to optimize flatness of display. Vary RF LEVEL up and down to see if the pattern maintains its shape. Make a compromise adjustment if necessary.

Notes

1. Receiver distortion can be calculated directly from the DUAL SWEEP display as follows:

Set SWEEP WIDTH to 150 kHz and calculate distortion as follows:

Peak I.M. Distortion =

$$\frac{\text{Peak-to-peak variation of the pattern top}}{\text{Average peak-to-peak pattern height}} \times 100\%$$

$$\text{Total Harmonic Distortion} = \frac{\text{Peak I.M. Distortion}}{5} \ (\pm 25\%)$$

2. Any sharp spikes in the bandpass are probably due to an oscillating IF stage, the stereo decoder (put the receiver in mono), or interference from a local station.

3. If the display drops suddenly to zero near the band edges, it is probably an audio stage clipping. This may not be significant, since we are sweeping the receiver over a wider band than it must normally handle. Narrowing SWEEP WIDTH should avoid this effect.

4. For receivers with fixed-tuned IF's, adjust the 1000A FREQUENCY so the IF center frequency corresponds with the center of the scope sweep display. The DUAL SWEEP pattern will fall to zero at the edges of the IF bandpass (Figure 5). Fine tune the 1000A until the middle portion of the DUAL SWEEP pattern is centered on the scope. Leave the 1000A tuned to this frequency while adjusting the discriminator and peak-tuning meter. If the discriminator is badly misaligned, some preliminary adjustment may be required while finding the IF center frequency.

5. For receivers with a zero-center-tuning meter, fine tune 1000A for the IF band center, as in note 4 above. Reduce SWEEP WIDTH to zero. Adjust discriminator secondary to zero the zero-center-tuning meter or to obtain zero volts at manufacturer's specified discriminator output test point. Set SWEEP WIDTH to 250 kHz, and adjust discriminator primary (usually the bottom slug) for optimum flatness of the DUAL SWEEP pattern.

Alternate Method — Monaural Alignment

In this method, the alignment is done while observing distortion of the receiver's audio output on a Distortion Analyzer rather than using DUAL SWEEP. The set-up is covered in the Alignment Chart, Step 5A. This method can lead to erroneous results because the alignment does not take into consideration what is happening on the band edges. The receiver may not respond well to modulation peaks and may be difficult to tune because of an unnecessarily abrupt change in linearity at one or both of the band edges. Keep in mind, also, that the alignment can be no better than the distortion of the generator being used. A low reading on the Distortion Analyzer means that the receiver has been aligned to have distortion equal to that of the generator, but with opposite phase. The 1000A has less than 0.1% distortion. If a generator with 1% distortion is used, a "perfect" alignment will result in the receiver having 1% distortion.

STEREO DECODER ALIGNMENT

Connect the equipment as shown in Figure 3. Set the 1000A and receiver controls as described in the Alignment Chart, Step 6.

SCA Trap

Connect the scope to a test point in the stereo demodulator between the SCA trap and the de-emphasis circuits. If a test point is not designated by the manufacturer, connect to the secondary of the 38 kHz transformer. Use a low capacitance probe. Adjust the SCA trap for minimum 67 kHz on the scope.

Note

Some manufacturers may have other SCA adjustments at fixed frequencies. In this case switch the 1000A to MONAURAL with the INPUT switch on EXT. Connect an external audio oscillator to the 1000A LEFT input and adjust the oscillator output for approximately 30% modulation. Then make the adjustments prescribed by the receiver manufacturer.

19 kHz Coils

Set up 1000A and receiver as described in the Alignment Chart, Step 7. There are two methods for aligning the 19 kHz coils. In this first method the 1000A PILOT LEVEL is gradually lowered while continuing to adjust for maximum separation as observed on the scope. Most receivers work down to 5% pilot. Be sure the left and right channels are not reversed while making this adjustment.

The second method requires connecting the vertical input of the scope to a test point in the receiver at the output of the final 19 kHz amplifier. The coils are then adjusted for maximum output of the 19 kHz.

38 kHz Coils

With 1000A and receiver settings as described in the Alignment Chart, Step 8, adjust the 38 kHz transformer for maximum audio output on the scope display. This adjustment provides minimum distortion and is not dependent on the setting of the receiver's Stereo Separation Control.

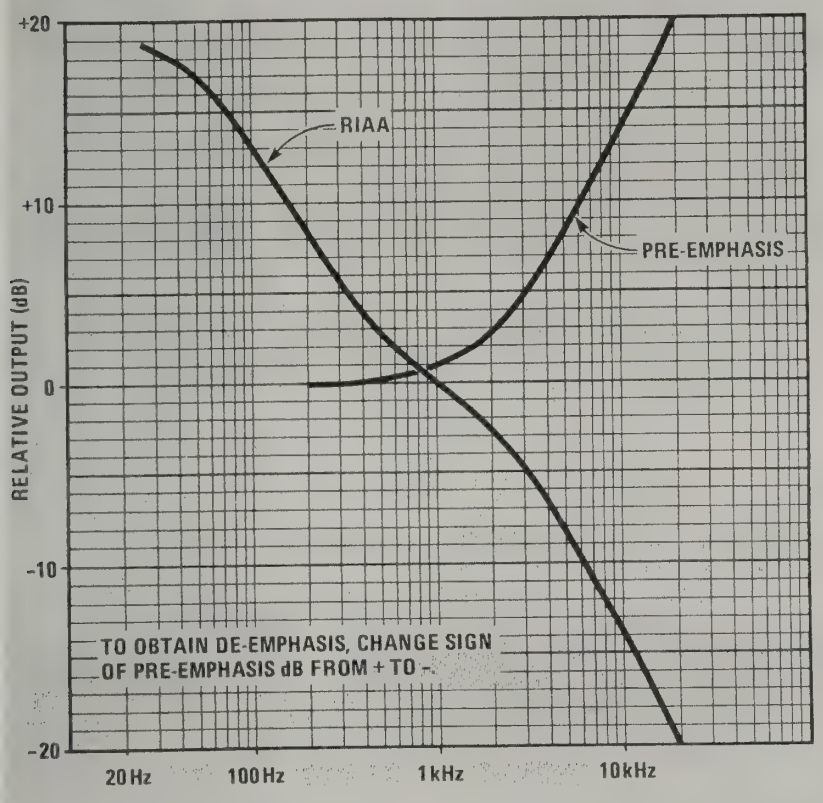
Stereo Separation Control

Adjust the receiver's separation control for maximum separation. A compromise adjustment may be required if left-to-right and right-to-left separations are unequal.

Note

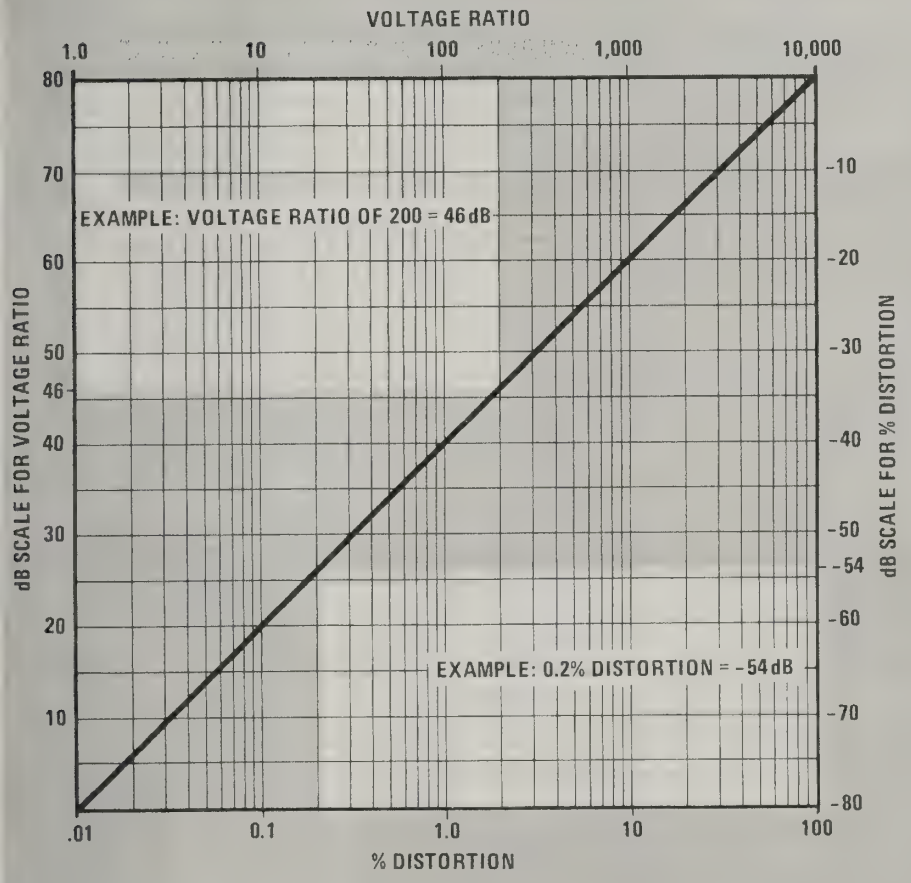
If you go back and adjust 19 or 38 kHz coils to improve separation, you will introduce audio distortion.

Conversion Charts

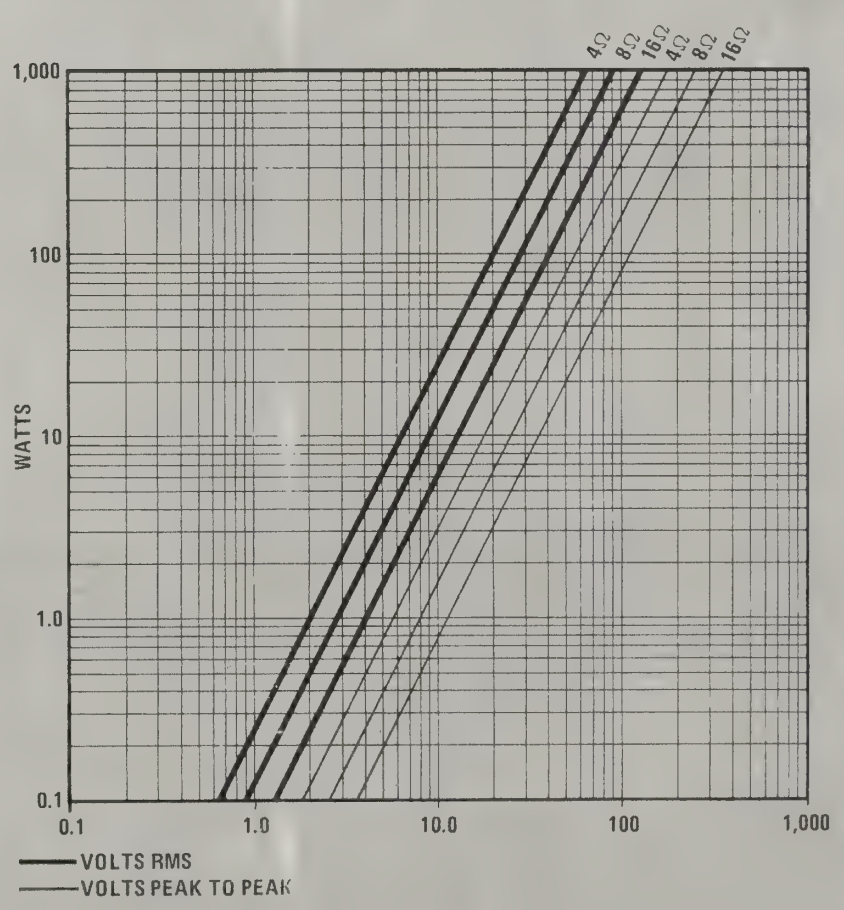


EQUALIZATION CURVES

	RIAA (dB)	DE-EMPHASIS (dB)	PRE-EMPHASIS (dB)
15 kHz	17.17	-17.07	+17.07
14	16.64	-16.49	+16.49
13	-15.95	-15.86	+15.86
12	-15.28	-15.18	+15.18
11	-14.55	-14.45	+14.45
10	-13.75	-13.66	+13.66
9	-12.88	-12.78	+12.78
8	-11.91	-11.82	+11.82
7	-10.85	-10.75	+10.75
6	-9.62	-9.54	+9.54
5	-8.23	-8.16	+8.16
4	-6.64	-6.58	+6.58
3	-4.76	-4.77	+4.77
2 kHz	-2.61	-2.76	+2.76
1000	0	-.87	+.87
700	+1.23	-.45	+.45
400	+3.81	-.15	+.15
300	+5.53	-.09	+.09
200	+8.22	-.04	+.04
100	+13.11	-.01	+.01
70	+15.31	.00	.00
50	+16.96	.00	.00
30	+18.61	.00	.00



dB CONVERSION



VOLTAGE-TO-POWER CONVERSION

SOUND TECHNOLOGY
1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008
(408) 378-6540

Printed in U.S.A. 7/74

Create Business with Tuner Clinics

Run an efficient and effective tuner clinic with the 1000A. Using the 1000A, you can fully test a receiver without even removing its covers. The 1000A is so fast to use that you can test a customer's receiver while he waits. Here are 5 important measurements that can be made in less than 5 minutes.

BANDWIDTH

___kHz measured at 300 μV input for 20% peak intermodulation distortion.

(This bandwidth is read directly in kHz on the 1000A front panel meter with SWEEP WIDTH increased until 20% curvature of the DUAL SWEEP pattern shows. This is an unconventional measurement but it tells a lot about the receiver. If bandwidth is less than about 250 kHz the receiver will be difficult to tune and distortion will be quite noticeable on modulation peaks. Here's where you see if the receiver needs alignment! For instance, if the pattern tilts in the center, the discriminator primary needs adjustment.)

DISTORTION

___% total harmonic distortion at 1000 μV input.

(This can be measured with DUAL SWEEP. Set SWEEP WIDTH to 150 kHz, RF LEVEL to 1000 μV and measure peak intermodulation distortion as described on page 6 under Discriminator Alignment. Divide by 5 to get equivalent THD with an accuracy of better than 25%.

If a THD analyzer is used, set the 1000A on MONAURAL, 400 Hz, 100% modulation. If a 1 kHz modulating frequency is used, the THD reading will be 20% to 36% low depending on whether the dominant harmonic content is second or third order. This is caused by the de-emphasis in the tuner.)

SENSITIVITY

___μV measured at ___MHz for 30 dB quieting.

(Set 1000A on MONAURAL, 400 Hz, 100% modulation RF LEVEL 1000 μV. Observe receiver audio output on a scope. Reduce 1000A RF LEVEL until noise appears approximately as shown in Figure 6 (3% noise): Read sensitivity on the RF LEVEL dial.

A more precise definition (IHF) requires the use of a THD analyzer. While measuring audio distortion, reduce RF LEVEL until analyzer reading increases to –30 dB (3% distortion plus noise).)

NOISE

___dB residual noise below 100% modulation at 1000 μV input (IHF Standard).

(First obtain a reference reading on an AC Voltmeter with 1000A on Monaural, 100% modulation, RF LEVEL 1000 μV. Then switch 1000A to CW. Read residual noise (dB below reference level) on the Voltmeter.)

SEPARATION

___dB Right,___dB Left, 1 kHz, 100% modulation.

(1000A on STEREO, INPUT switch on LEFT then on RIGHT.)

Furnish your customer a record of the results of tests made on his receiver. Reprint the form below for use as a clinic test card.

TUNER CLINIC

YOUR LETTERHEAD

UNIT NO. _____

CLAIM TAG _____

DATE _____

CUSTOMER NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

BRAND _____ MODEL _____ SERIAL _____

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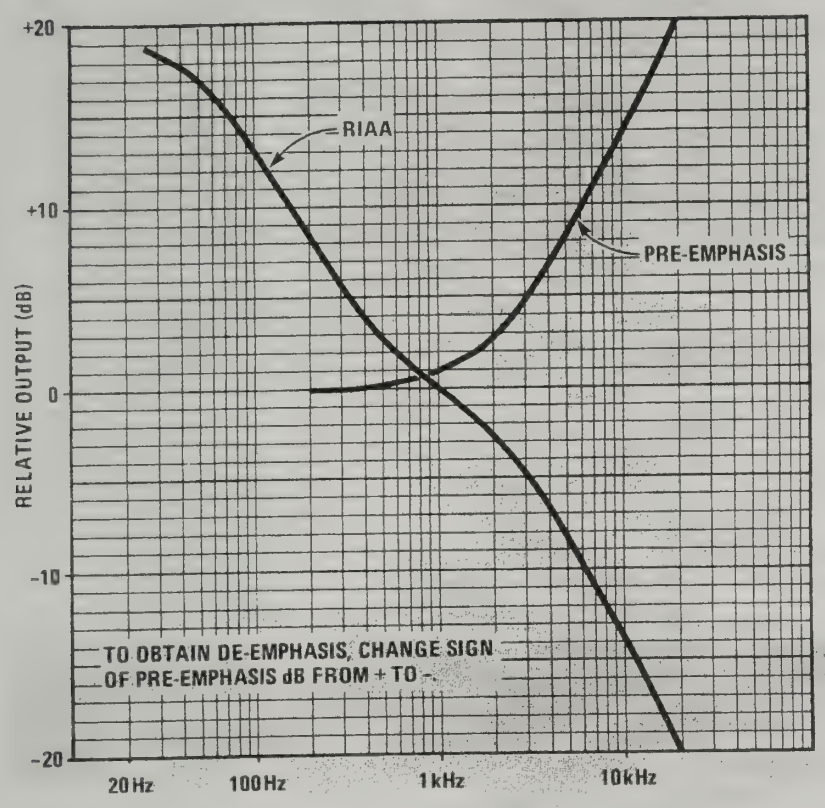
SENSITIVITY _____ μV measured at _____ MHz for 30 dB quieting.

NOISE _____ dB residual noise below 100% modulation at 1000 μV input.

SEPARATION _____ dB Right _____ dB Left, 1 kHz, 100% modulation.

Technician _____ _____

Conversion Charts



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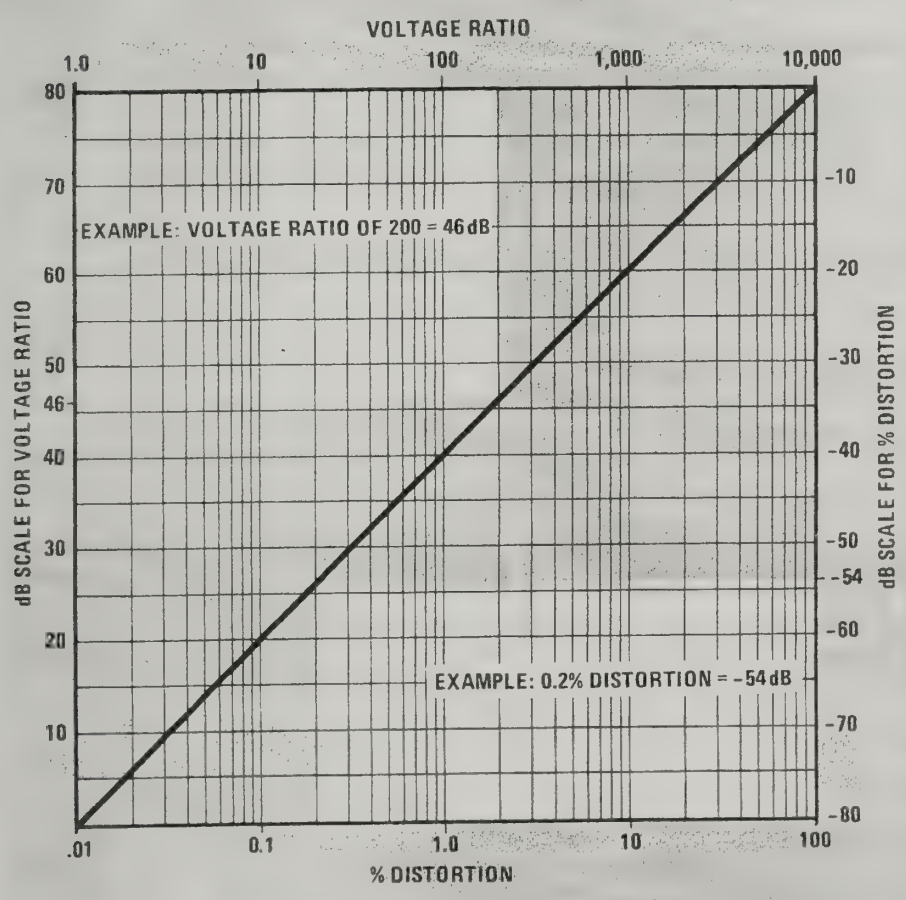
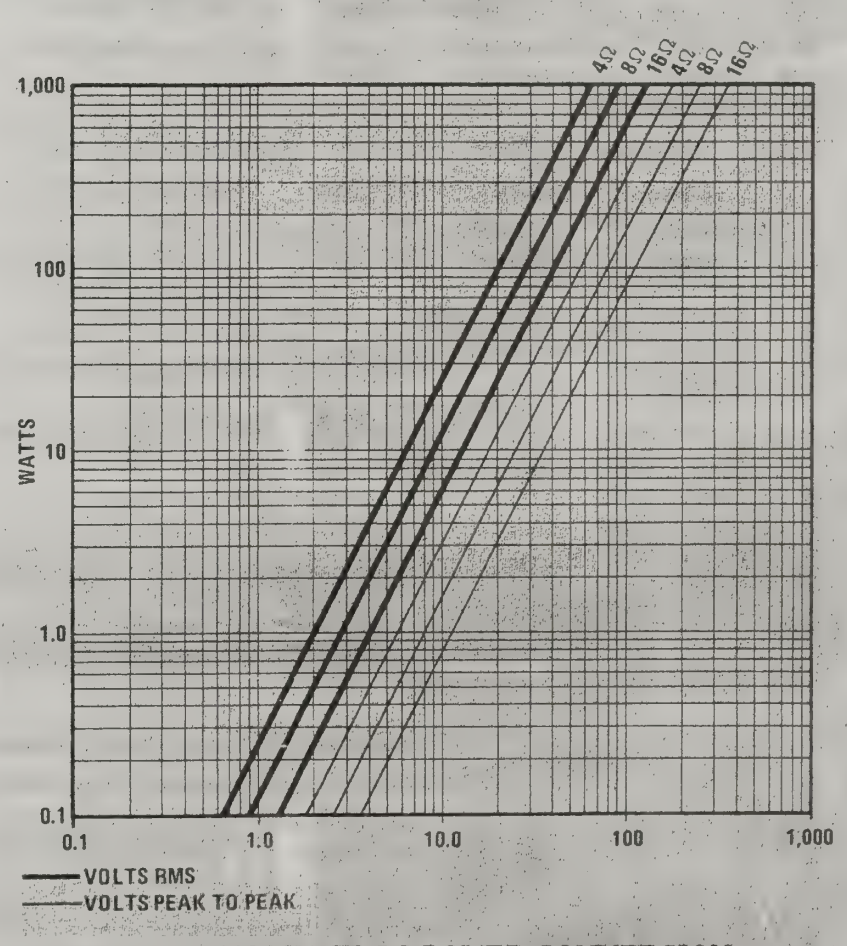


dB CONVERSION



VOLTAGE-TO-POWER CONVERSION

SOUND TECHNOLOGY
1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008
(408) 378-8500

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NOISE

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(First obtain a reference reading on an AC Voltmeter with 1000A on Monaural, 100% modulation, RF LEVEL 1000 μV. Then switch 1000A to CW. Read residual noise (dB below reference level) on the Voltmeter.)

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(1000A on STEREO, INPUT switch on LEFT then on RIGHT.)

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TUNER CLINIC

YOUR LETTERHEAD

UNIT NO. _____

CLAIM TAG _____

DATE _____

CUSTOMER NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

BRAND _____ MODEL _____ SERIAL _____

BANDWIDTH _____ kHz Measured at 300 μV input for 20% peak intermodulation distortion.

DISTORTION _____ % total harmonic distortion at 1000 μV input.

SENSITIVITY _____ μV measured at _____ MHz for 30 dB quieting.

NOISE _____ dB residual noise below 100% modulation at 1000 μV input.

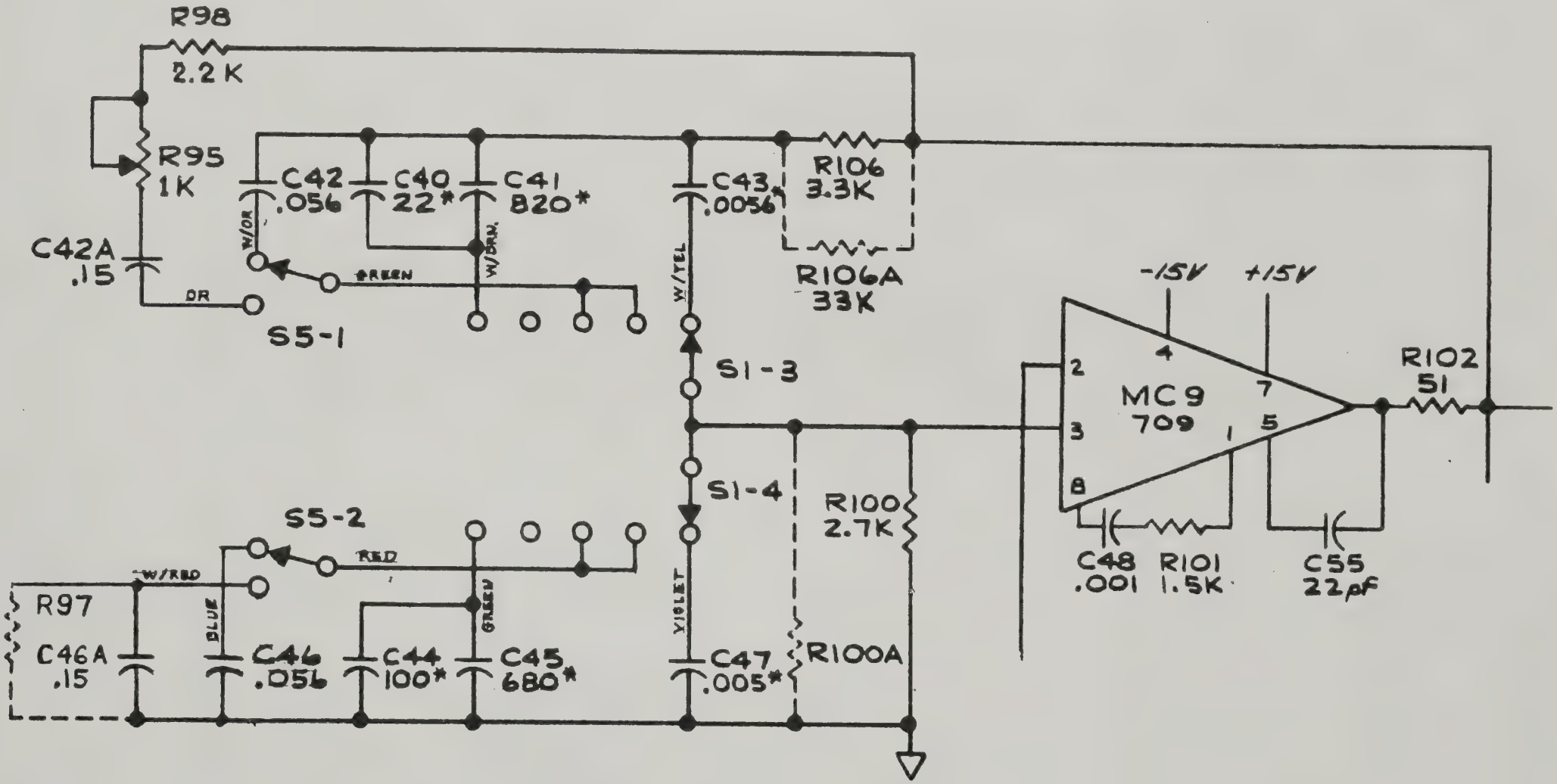
SEPARATION _____ dB Right _____ dB Left, 1 kHz, 100% modulation.

Technician _____

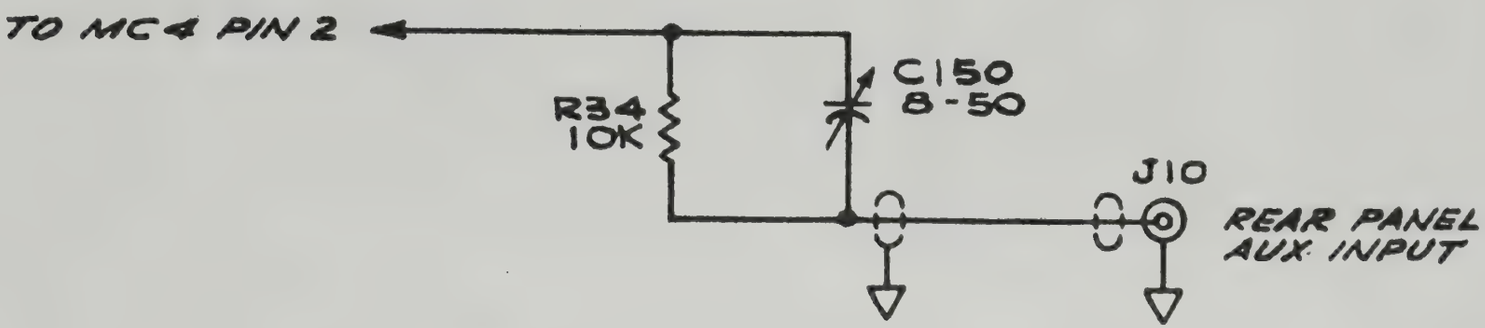
FREQUENCY SELECT SWITCH
(ON FRONT PANEL)

SOUND TECHNOLOGY
CAMPBELL CALIFORNIA 95008 (408) 378 6540

CIRCUIT LAYOUTS
MODEL 1000A M2

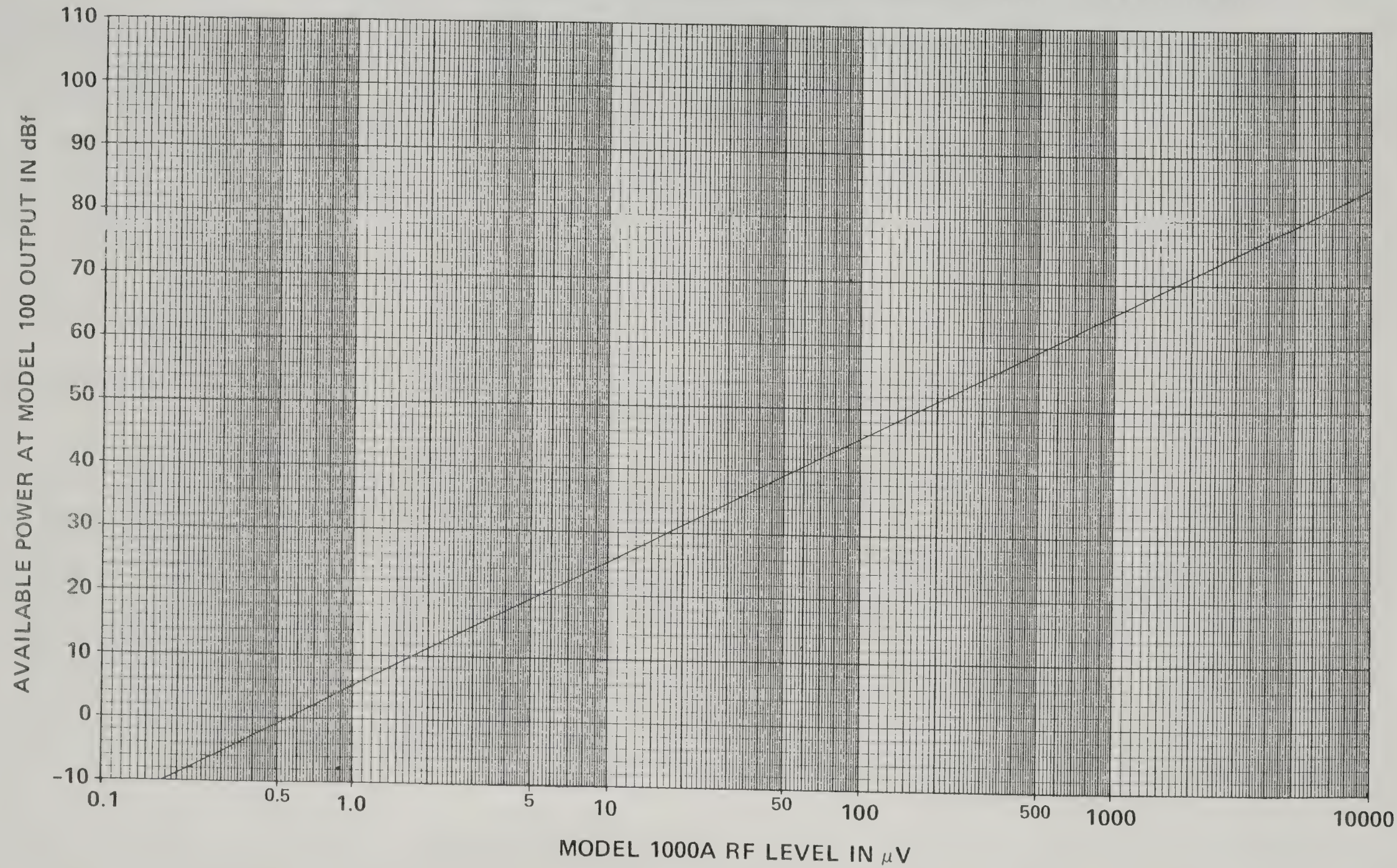


Internal Oscillator Option M-2



AUXILIARY INPUT - OPTION M1

MODEL 1000A FM ALIGNMENT GENERATOR OUTPUT IN μV
VS.
AVAILABLE POWER AT MODEL 100 MATCHING TRANSFORMER OUTPUT IN dBf



SOUND TECHNOLOGY

1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008

1000A FM ALIGNMENT GENERATOR

PURCHASED PARTS

PART NO	DESCRIPTION	QTY
0005-0004	TRANS 2N3054 NPN SI Q13-15	3.0
2040-0001	CAP-FXD 0.01UF 2KV CERAMIC C98,99	2.0
2100-0011	CAP-FXD 1500UF 50V ELECT AL C82,83	2.0
3005-0001	SWITCH-SLIDE,LINE SELECT S6	1.0
3100-0000	CONNECTOR-BNC JACK,SHORT J10	1.0
3110-0000	CONNECTOR-AC RECEPTACLE	1.0
3150-0000	PLATE-CAP MOUNTING	2.0
3150-0003	INSULATOR-TRANS, TO-66 NYLON	3.0
3200-0001	TRANSFORMER-POWER 1000A, 1100A T1	1.0
3200-0004	END CAP,SMALL-XFMR 1000A	1.0
3300-0000	FILTER-FOR 1000A OPT 003	1.0
3480-0001	FUSE-1/2 AMP, 3AG F1	1.0
3485-0000	FUSE HOLDER, 3AG XF1	1.0
7100-0000	CABLE ASSY-LINE CORD W1	1.0
7600-0001	CARTON/FOAM 1000A	1.0
8000-0003	KNOB-BAR & SKIRT BLK	2.0
8000-0004	KNOB-ROUND 23/32DIA BLK	4.0
8000-0005	KNOB-ROUND 1 1/4DIA BLK	2.0
8020-0002	PLUG-HOLE 3/8" HOLE, STL	1.0
8020-0002	PLUG-HOLE 3/8" HOLE, STL	-1.0
8030-0000	CLAMP-CABLE	4.0
8030-0002	TIE-CABLE	15.0
8030-0003	CLAMP-CABLE 3/16	1.0
8050-0000	LABEL-SERIAL TAG	1.0
8300-0000	CABINET-1000A	1.0
8610-0001	CLIP NUT- 6-32	2.0
8650-0006	LUG,SOLDER-#6 INT LOCK	5.0
8702-0001	SPACER-THD,6-32 X 1.5LG,1/4HEX	1.0
01000-1009	SIDE PANELS 1000A LH/RH PAIR	1.0
01000-1010	REAR CHASSIS 1000A	1.0

SUBASSEMBLY PARTS

PART NO	DESCRIPTION	QTY
01000-30003	ASSY-PC, MAIN	1.0
01000-30005	ASSY-RF	1.0
01000-30006	ASSY-FRONT PANEL	1.0

01000-30003 ASSY-PC, MAIN

PART NO	DESCRIPTION	QTY
0000-0001	TRANS 2N3644 PNP SI Q3,4,6,7	4.0
0005-0003	TRANS 2N3391 NPN SI Q5,9,11,16-19,21	8.0
0010-0001	TRANS 2N404 NPN GE Q12	1.0
0020-0000	TRANS-FET MEM511C MOS P-CHAN Q20	1.0
0020-0001	TRANS-FET VCR3P P-CHAN Q8	1.0
0025-0001	TRANS-FET 2N3819 N-CHAN Q10	1.0
0025-0002	TRANS-FET 2N3819 MATCHED PAIR Q1,2	1.0
0100-0004	IC-REGULATOR 723, TO-5 10 PIN MC11	1.0
0100-0011	IC-OP AMP 709 MC1-6,9,10	8.0
0110-0001	IC-QUAD 2-INPUT GATE MC7	1.0
0110-0002	IC-DUAL JK FLIP FLOP MC8	1.0
0200-0000	DIODE-GEN 1N914A SI CR1-9	9.0
0200-0001	DIODE-RECT 1N4003 SI CR11-14	4.0
1015-0200	RES-FXD 200 1% 1/8W MF R140	1.0
1015-0200	RES-FXD 200 1% 1/8W MF R190	1.0
1015-0316	RES-FXD 316 1% 1/8W MF R191	1.0
1015-1100	RES-FXD 1K 1% 1/8W MF R37,44,193	3.0
1015-1121	RES-FXD 1.21K 1% 1/8W MF R53	1.0
1015-1200	RES-FXD 2K 1% 1/8W MF R192	1.0
1015-1205	RES-FXD 2.05K 1% 1/8W R18	1.0
1015-1301	RES-FXD 3.01K 1% 1/8W R23	1.0
1015-1422	RES-FXD 4.22K 1% 1/8W MF R51	1.0
1015-1422	RES-FXD 4.22K 1% 1/8W MF R202,203	2.0
1015-1715	RES-FXD 7.15K 1% 1/8W MF R166	1.0
1015-1787	RES-FXD 7.87K 1% 1/8W MF R43,165	2.0
1015-1866	RES-FXD 8.66K 1% 1/8W R6	1.0
1015-1953	RES-FXD 9.53K 1% 1/8W R141	1.0
1015-2100	RES-FXD 10K 1% 1/8W MF R4,11,12,16	4.0
1015-2365	RES-FXD 36.5K 1% 1/8W R46	1.0
1015-2590	RES-FXD 59K 1% 1/8W MF R17	1.0
1015-2732	RES-FXD 73.2K 1% 1/8W MF R3,17	2.0
1015-2732	RES-FXD 73.2K 1% 1/8W MF R17	-1.0
1015-2750	RES-FXD 75K 1% 1/8W MF R10	1.0
1015-2750	RES-FXD 75K 1% 1/8W MF R204,205	2.0
1100-0005	RES-FXD 5.1 5% 1/4W R164,176	2.0
1100-0027	RES-FXD 27 5% 1/4W R207	1.0
1100-0051	RES-FXD 51 5% 1/4W R42,102,194	3.0
1100-0075	RES-FXD 75 5% 1/4W R61	1.0
1100-0120	RES-FXD 120 5% 1/4W R149	1.0
1100-0220	RES-FXD 220 5% 1/4W R62,136,142	3.0
1100-0270	RES-FXD 270 5% 1/4W R163	1.0
1100-0330	RES-FXD 330 5% 1/4W R36	1.0
1100-0330	RES-FXD 330 5% 1/4W R36	-1.0
1100-0390	RES-FXD 390 5% 1/4W R138	1.0
1100-0470	RES-FXD 470 5% 1/4W R71,75	2.0
1100-0560	RES-FXD 560 5% 1/4W R1A,52A,65	3.0
1100-0680	RES-FXD 680 5% 1/4W R19A,21,22,73,77	5.0
1100-0820	RES-FXD 820 5% 1/4W R143	1.0
1100-0820	RES-FXD 820 5% 1/4W R49	1.0
1100-1100	RES-FXD 1K 5% 1/4W R63,69,98,99,132,189	6.0
1100-1100	RES-FXD 1K 5% 1/4W R40,92	2.0

PART NO	DESCRIPTION	QTY
3105-0002	SOCKET-CRYSTAL	1.0
3150-0001	PAD-TRANSISTOR MOUNTING	5.0
3255-0000	COIL ASSY-TORROID L2	1.0
3255-0000	COIL ASSY-TORROID L2	-1.0
3255-0001	COIL ASSY-TORROID L1	1.0
3255-0001	COIL ASSY-TORROID L1	-1.0
3255-0002	COIL ASSY-TORROID L3	1.0
3255-0002	COIL ASSY-TORROID L3	-1.0
3350-0000	CRYSTAL-152KHZ 0.005% 20PF Y1	1.0
8510-0004	SCRFW 2-56 X 1/4 POZI PAN HD	1.0
8512-0002	LOCKWASHER-INT #2	1.0
8518-0001	NUT-HEX 2-56 X 3/16	1.0
01000-5003	PC BOARD-MAIN 1000A	1.0

01000-30005 ASSY-RF

PART NO	DESCRIPTION	QTY
1100-0051	RES-FXD 51 5% 1/4W R186	1.0
2050-0000	CAP-FEEDTHRU 0.001UF CERAMIC C110	1.0
2050-0001	CAP-FILTER,FEEDTHRU 0.001UF FLT102,103	2.0
2200-0000	CAP-VAR 2.8-20PF AIR C106	1.0
3100-0002	CONNECTOR-BNC REAR MOUNTING J5	1.0
3260-0000	COIL-FXD 2.2UH L6,7	2.0
7050-0001	CABLE-50 OHM	1.4
7790-0000	CAN-ALUM	1.0
7790-0001	LID-ALUM	1.0
8020-0003	GROMMET-RUBBER,3/16ID 5/16HOLE	1.0
8060-0000	BRAID-RFI MESH 3/16 X 1/8	1.2
8060-0001	BRAID-RFI MESH 1/8 X 3/32	0.4
8060-0002	BUSHING-RFI BRAID, 1000A	1.0
8100-0001	SHAFT-1/4DIA X 2"LG, SS	1.0
8110-0000	GEAR-ANTI BACKLASH	1.0
8110-0002	GEAR-RACK	0.4
8130-0000	PIN-SPIROL	1.0
8140-0000	GRIP RING- 1/4"	1.0
8150-0001	FINGERS-CONTACT	1.0
8548-0002	LOCKNUT-HEX 6-32 ESNA	4.0
8700-0000	SPACER-#6 X 3/8LG 1/4OD, BRS	3.0
8700-0003	SPACER-#6 X 7/8LG 1/4OD, BRS	2.0
01000-1002	BRACKET-ATTENUATOR, LOWER	1.0
01000-1003	BRACKET-ATTENUATOR, UPPER	1.0
01000-1004	CLIP	1.0
01000-1014	PLATE-SHIELD RETAINING	1.0
01000-2006	TUBE-PROBE	1.0
01000-2007	HUB-FINGERS	1.0
01000-2008	RING-RETAINER	1.0
01000-2013	SUPPORT-RACK & PINION, DELRIN	1.0
01000-2024	RFI BUSHING	1.0

SUBASSEMBLY PARTS

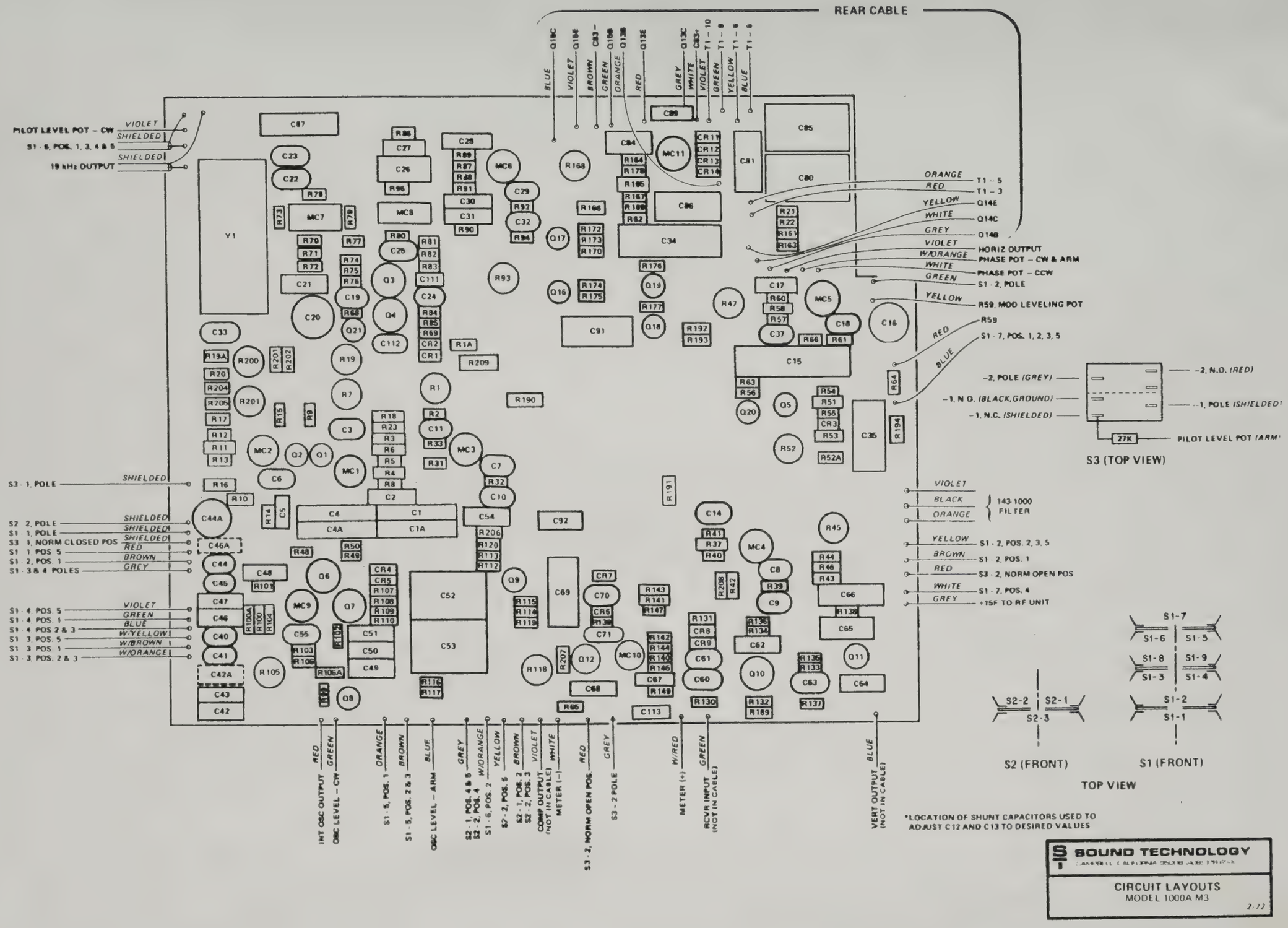
PART NO	DESCRIPTION	QTY
01000-30002	ASSEMBLY-TUBE 1000A	1.0
01000-30004	ASSY-PC, RF	1.0

01000-30004 ASSY-PC, RF

PART NO	DESCRIPTION	QTY
0005-0005	TRANS-2N4996 GRADE 1 (1000A) Q30	1.0
0200-0000	DIODE-GEN 1N914A SI CR20	1.0
0210-0000	DIODE-VARACTOR MV833 CR21	1.0
1100-0051	RES-FXD 51 5% 1/4W R188	1.0
1100-0820	RES-FXD 820 5% 1/4W R185	1.0
1100-1560	RES-FXD 5.6K 5% 1/4W R184	1.0
1100-2100	RES-FXD 10K 5% 1/4W R187	1.0
1100-2150	RES-FXD 15K 5% 1/4W R183	1.0
1100-3100	RES-FXD 100K 5% 1/4W R180	1.0
2000-0007	CAP-FXD 7PF 5% 500V MICA C108A	1.0
2000-0056	CAP-FXD 56PF 5% 500V MICA C105	1.0
2000-0120	CAP-FXD 120PF 5% 500V MICA C109	1.0
2040-0003	CAP-FXD 0.005UF 100V CERAMIC C100,101,104	3.0
2205-0001	CAP-VAR 2 1/2-6PF TRIMMER CER C107	1.0
2205-0002	CAP-VAR 3 1/2-13PF TRIMMER CER C108	1.0
3260-0001	COIL-FXD 4.7UH L5	1.0
7005-0001	WIRE-BUSS 16 AWG	1.0
8720-0002	TERMINAL-BIFURCATED,SWAGE-IN	4.0
01000-5004	PC BOARD-RF 1000A	1.0

01000-30006 ASSY-FRONT PANEL

PART NO	DESCRIPTION	QTY
1100-2270	RES-FXD 27K 5% 1/4W R30,171	2.0
1400-0000	RES-VAR 1K 10% 2W CARBON R45,111	2.0
1400-0003	RES-VAR 5K 10% 2W CARBON R179	1.0
1400-0004	RES-VAR 5K 10% 2W REAR SHAFT R59	1.0
1400-0005	RES-VAR 10K 10% 2W CARBON R162	1.0
3000-0002	SWITCH-TOGGLE SPST S4	1.0
3000-0003	SWITCH-TOGGLE 2PDT S5	1.0
3010-0002	SWITCH-ROTARY 1000A FUNCTION S1	1.0
3010-0003	SWITCH-ROTARY 1000A INPUT S2	1.0
3015-0005	SWITCH-PUSHBUTTON S3	1.0
3100-0000	CONNECTOR-BNC JACK,SHORT J1-4,6-9	8.0
3320-0001	METER 0-500UA DC 1000A M1	1.0
3440-0001	LAMP-NEON, RED DS1	1.0
8100-0000	SHAFT-1/4 DIA X 6 1/8 LG, SS	1.0
8105-0000	DIAL-UNFINISHED	2.0
8105-0001	DIAL-FREQUENCY	1.0
8105-0002	DIAL-RF LEVEL	1.0
8110-0001	DRIVE-PLANETARY	1.0
8120-0000	COUPLER-FLEXIBLE 1/4-1/4	2.0
8650-0008	LUG,SOLDER-#8 INT LOCK	3.0
8650-0014	LUG,SOLDER-1/4 INT LOCK	2.0
8700-0000	SPACER-#6 X 3/8LG 1/4OD, BRS	2.0
8700-0002	SPACER-#6 X 1/2LG 1/4OD, BRS	1.0
01000-1006	FRONT PANEL, STANDARD 1000A	1.0
01000-1006	FRONT PANEL, STANDARD 1000A	-1.0
01000-1011	BRACKET-POTENTIOMETER	1.0
01000-1013	FRONT PANEL 1000A OPT 002	1.0
01000-2012	COUPLER-SOLID, POT/CAPACITOR	1.0
01000-2021	BLOCK-CLAMPING	1.0
01000-2025	HUB-DIAL	1.0


REAR CABLE
PILOT LEVEL POT – CW
S1 - 6, POS. 1, 3, 4 & 5
19 kHz OUTPUT
VIOLET
SHIELDED
SHIELDED
Y1
S3 - 1, POLE
S2 - 2, POLE
S1 - 1, POLE
S3 - 1, NORM CLOSED POS
S1 - 1, POS. 5
S1 - 2, POS. 1
S1 - 3 & 4 POLES
S1 - 4, POS. 5
S1 - 4, POS. 1
S1 - 4, POS 2 & 3
S1 - 3, POS. 5
S1 - 3 POS. 1
S1 - 3, POS. 2 & 3
ORANGE
RED
YELLOW
WHITE
GREY
VIOLET
W/ORANGE
WHITE
GREEN
YELLOW
R59, MOD LEVELING POT
R59
S1 - 7, POS. 1, 2, 3, 5
T1 – 5
T1 – 3
Q14E
Q14C
Q14B
HORIZ OUTPUT
PHASE POT – CW & ARM
PHASE POT – CCW
S1 - 2, POLE
-2, POLE (GREY)
-1, N.O. (BLACK, GROUND)
-1, N.C. (SHIELDED)
-2, N.O. (RED)
-1, POLE (SHIELDED)
27K
PILOT LEVEL POT (ARM)
S3 (TOP VIEW)
VIOLET
BLACK
ORANGE
143-1000 FILTER
YELLOW
BROWN
RED
WHITE
GREY
S1 - 2, POS. 2, 3, 5
S1 - 2, POS. 1
S3 - 2, NORM OPEN POS
S1 - 7, POS. 4
+15F TO RF UNIT
INT OSC OUTPUT
OSC LEVEL – CW
S1 - 5, POS. 1
S1 - 5, POS. 2 & 3
OSC LEVEL – ARM
S2 - 1, POS. 4 & 5
S2 - 2, POS. 4
S1 - 6, POS. 2
S2 - 1, POS. 5
S2 - 1, POS. 2
S2 - 2, POS. 3
COMP OUTPUT (NOT IN CABLE)
METER (–)
S3 - 2, NORM OPEN POS.
S3 - 2 POLE
METER (+)
RCVR INPUT (NOT IN CABLE)
VERT OUTPUT (NOT IN CABLE)
S2 (FRONT)
S1 (FRONT)
TOP VIEW
*LOCATION OF SHUNT CAPACITORS USED TO ADJUST C12 AND C13 TO DESIRED VALUES
SOUND TECHNOLOGY
CIRCUIT LAYOUTS
MODEL 1000A M3
2-72

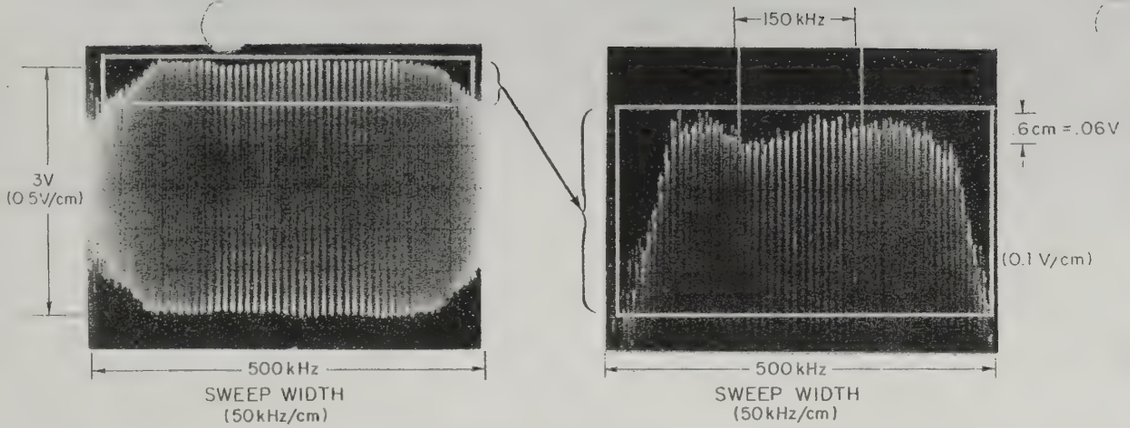


Fig. 4(a). Fig. 4(b)
Top of alignment pattern in (a) is magnified 5 times in (b) to facilitate measuring ripple. Ripple across top is caused by receiver non-linearity and is a direct measure of the receiver's peak intermodulation distortion. Numbers are discussed in article.

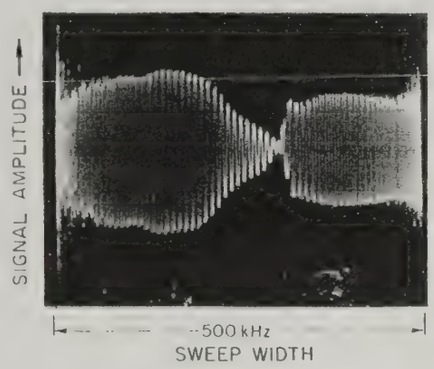


Fig. 5. Two-plateau receiver alignment pattern caused by mis-aligned receiver. This receiver tunes in same station at two adjacent points on dial. Narrowness of pattern plateau means receiver has inadequate bandwidth for high modulations and is hard to tune to stations.

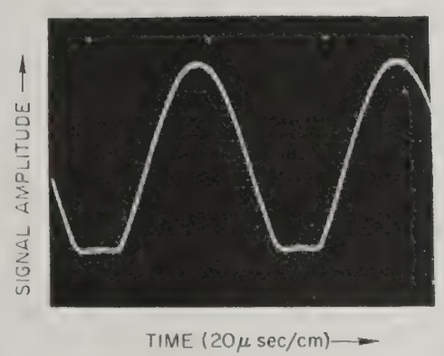
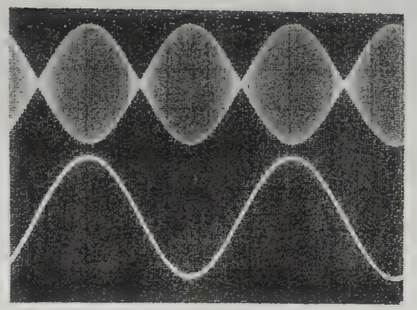
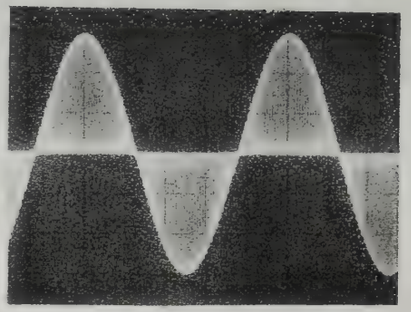
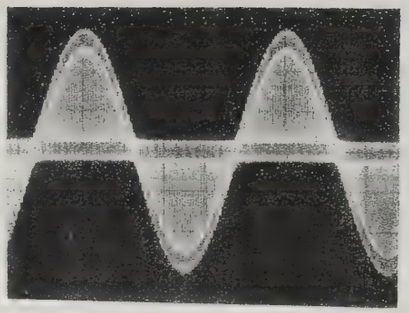


Fig. 6. Audio test signal obtained from receiver of Fig. 5 when receiver was tuned to right-hand plateau in Fig. 5. Noise visible on waveform peaks and severe clipping on waveform troughs is caused by narrowness of plateau in Fig. 5.


(a)


(b)


(c)

(a). Upper trace shows L - R signal and lower trace L + R signal (both 1 kHz) from new generator. These signals are obtained merely by switching generator's input switch between adjacent positions.

(b). Generator's left only (or right only) composite signal without pilot. This output is obtained by switching to third position on generator's input switch.

(c). Generator's composite signal, as in (b), but now with pilot added. Pilot is added merely by turning up generator's oscillator level control.

Fig. 7. Stereo signals produced by new Sound Technology FM Alignment Generator.

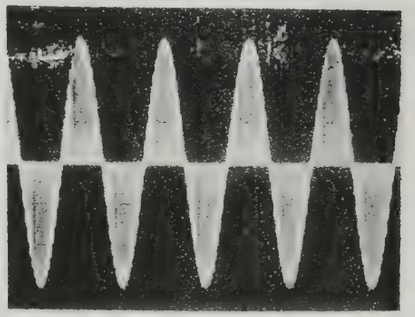
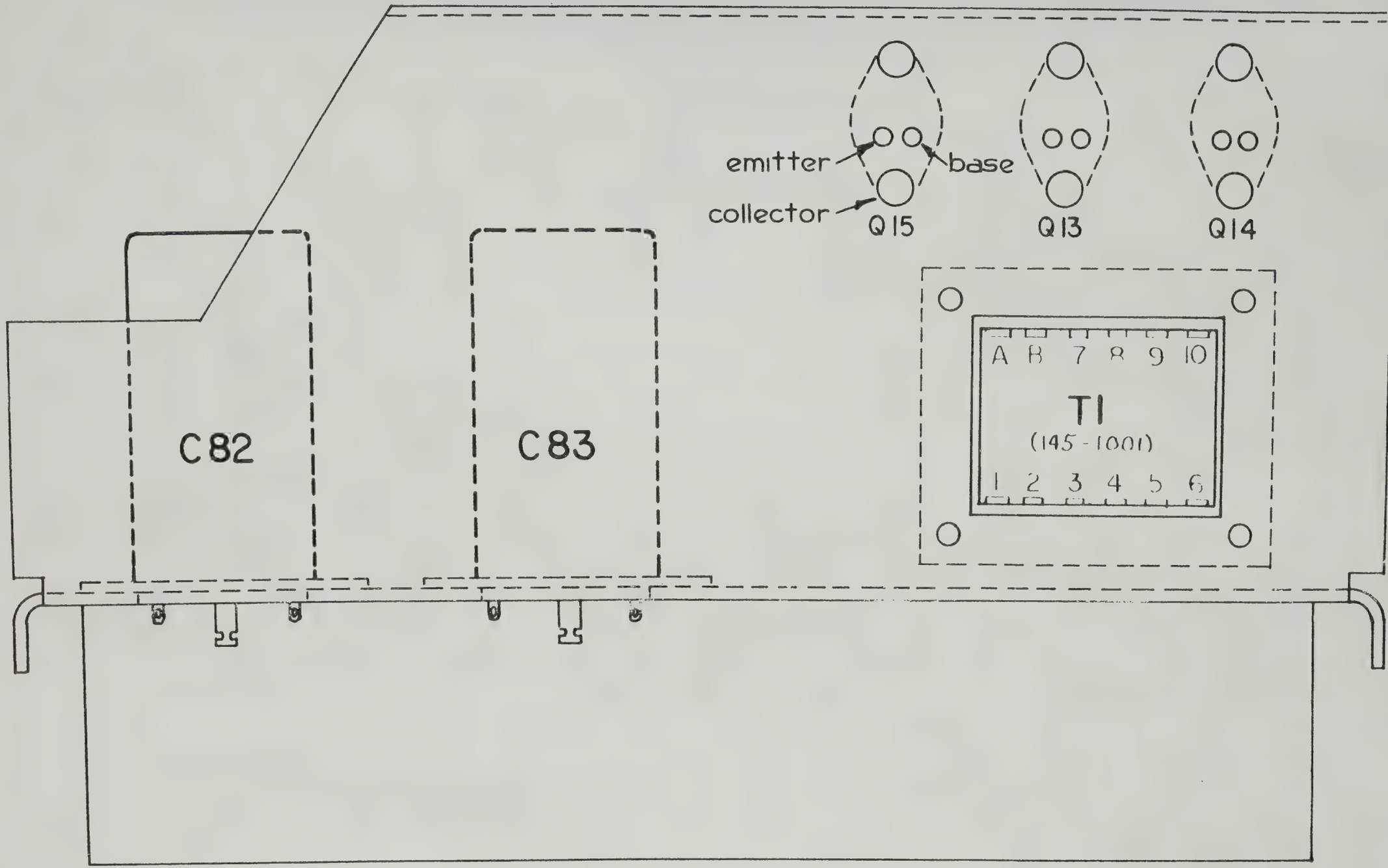
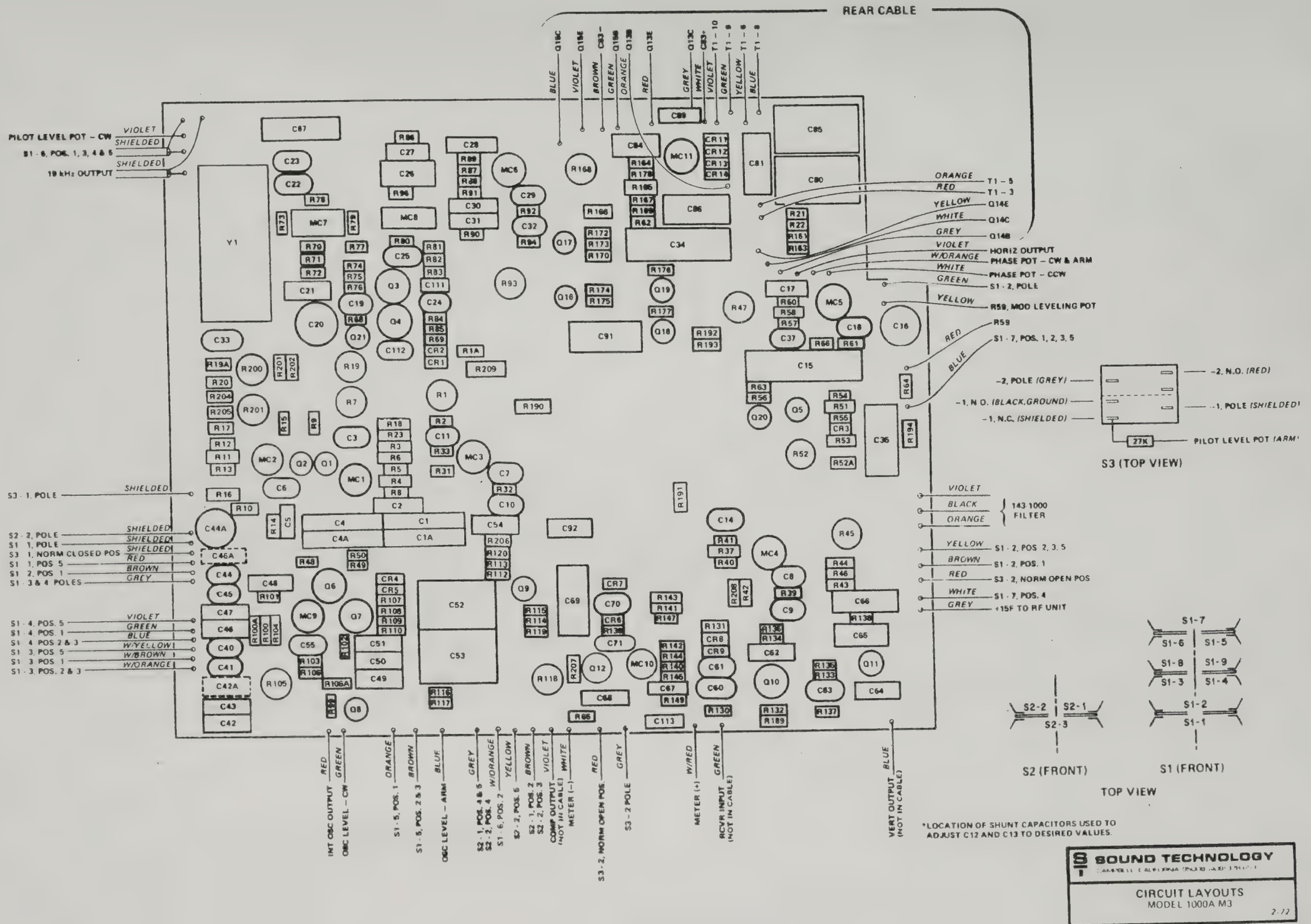


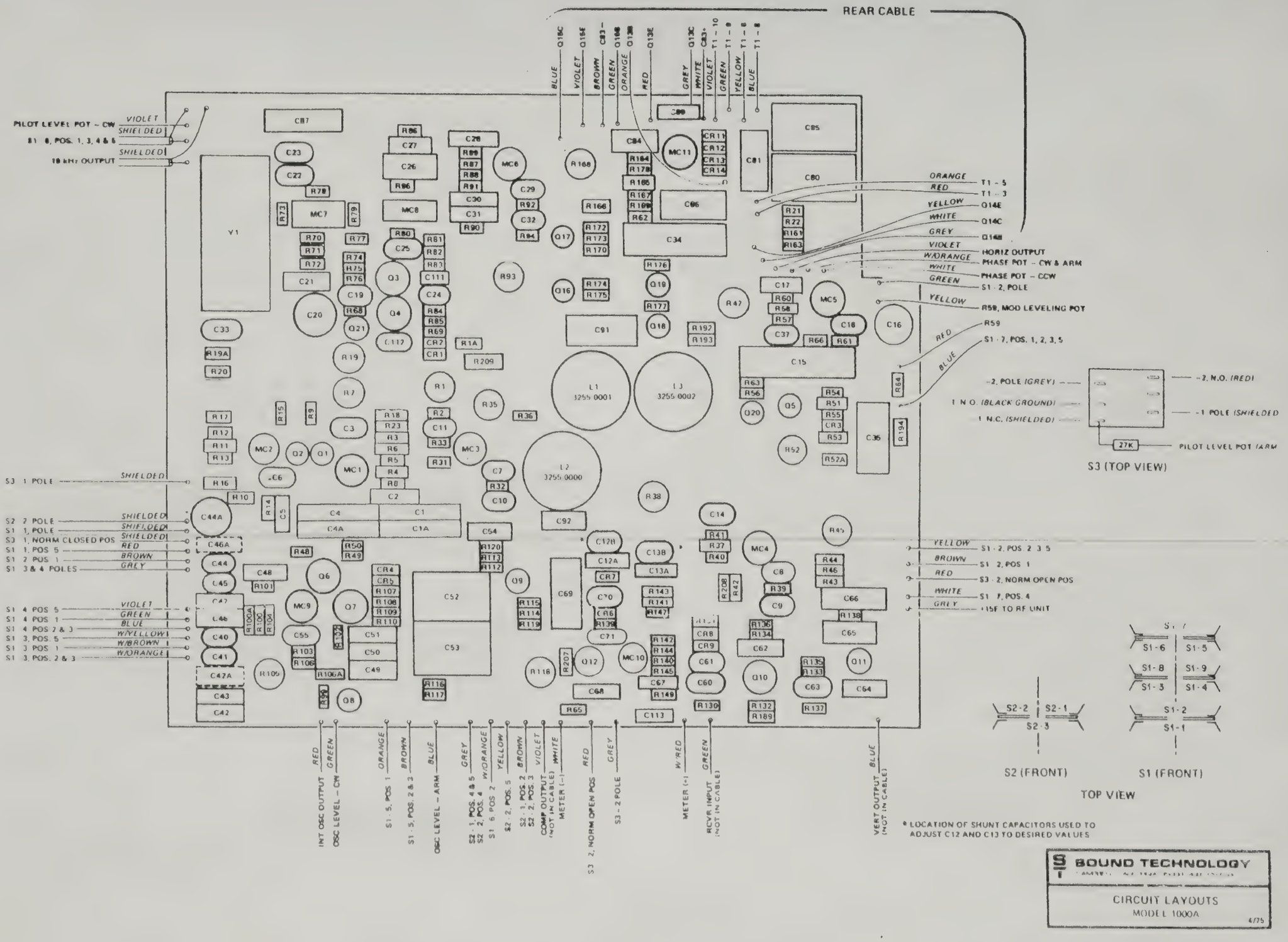
Fig. 8. Same as Fig. 7(b) except on slower time scale to illustrate generator's high channel separation of 50 dB or more (indicated by flatness of base line).



FRONT VIEW

Figure 7. Chassis parts layout


REAR CABLE
PILOT LEVEL POT – CW
S1 - 6, POS. 1, 3, 4 & 5
19 kHz OUTPUT
VIOLET
SHIELDED
ORANGE
RED
YELLOW
WHITE
GREY
VIOLET
W/ORANGE
WHITE
GREEN
HORIZ OUTPUT
PHASE POT – CW & ARM
PHASE POT – CCW
S1 - 2, POLE
R59, MOD LEVELING POT
R59
S1 - 7, POS. 1, 2, 3, 5
-2, POLE (GREY)
-1, N.O. (BLACK, GROUND)
-1, N.C. (SHIELDED)
-2, N.O. (RED)
-1, POLE (SHIELDED)
27K
PILOT LEVEL POT (ARM)
S3 (TOP VIEW)
S3 - 1, POLE
S2 - 2, POLE
S1 - 1, POLE
S3 - 1, NORM CLOSED POS
S1 - 1, POS. 5
S1 - 2, POS. 1
S1 - 3 & 4 POLES
S1 - 4, POS. 5
S1 - 4, POS. 1
S1 - 4, POS. 2 & 3
S1 - 3, POS. 5
S1 - 3, POS. 1
S1 - 3, POS. 2 & 3
VIOLET
BLACK
ORANGE
143-1000 FILTER
YELLOW
BROWN
RED
WHITE
GREY
S1 - 2, POS. 2, 3, 5
S1 - 2, POS. 1
S3 - 2, NORM OPEN POS
S1 - 7, POS. 4
+15F TO RF UNIT
S1-7
S1-6
S1-5
S1-8
S1-9
S1-3
S1-4
S1-2
S1-1
S2-2
S2-1
S2-3
S2 (FRONT)
S1 (FRONT)
TOP VIEW
INT OSC OUTPUT
OSC LEVEL – CW
S1 - 5, POS. 1
S1 - 5, POS. 2 & 3
OSC LEVEL – ARM
S2 - 1, POS. 4 & 5
S2 - 2, POS. 4
S1 - 6, POS. 2
S2 - 2, POS. 5
S2 - 1, POS. 2
S2 - 2, POS. 3
COMP OUTPUT (NOT IN CABLE)
METER (–)
S3 - 2, NORM OPEN POS
S3 - 2 POLE
METER (+)
RCVR INPUT (NOT IN CABLE)
VERT OUTPUT (NOT IN CABLE)
*LOCATION OF SHUNT CAPACITORS USED TO ADJUST C12 AND C13 TO DESIRED VALUES.
SOUND TECHNOLOGY
CIRCUIT LAYOUTS
MODEL 1000A M3
2-72


REAR CABLE
PILOT LEVEL POT – CW
S1 8, POS. 1, 3, 4 & 5
10 kHz OUTPUT
S3 1 POLE
S2 2 POLE
S1 1, POLE
S3 1, NORM CLOSED POS
S1 1, POS 5
S1 2 POS 1
S1 3 & 4 POLES
S1 4 POS 5
S1 4 POS 1
S1 4 POS 2 & 3
S1 3, POS. 5
S1 3 POS 1
S1 3, POS. 2 & 3
T1 - 5
T1 - 3
Q14E
Q14C
Q14B
HORIZ OUTPUT
PHASE POT – CW & ARM
PHASE POT – CCW
S1 - 2, POLE
R59, MOD LEVELING POT
R59
S1 - 7, POS. 1, 2, 3, 5
-2, POLE (GREY)
1 N.O. (BLACK GROUND)
1 N.C. (SHIELDED)
-2, N.O. (RED)
-1 POLE (SHIELDED
27K
PILOT LEVEL POT (ARM
S3 (TOP VIEW)
S1 - 2, POS. 2 3 5
S1 2, POS 1
S3 - 2, NORM OPEN POS
S1 7, POS. 4
(15F TO RF UNIT
INT OSC OUTPUT
OSC LEVEL – CW
S1 - 5, POS 1
S1 - 5, POS. 2 & 3
OSC LEVEL – ARM
S2 - 1, POS. 4 & 5
S2 - 2, POS. 4
S1 6, POS 2
S2 - 2, POS. 5
S2 - 1, POS. 2
S2 - 2, POS. 3
COMP OUTPUT (NOT IN CABLE)
METER (–)
S3 - 2, NORM OPEN POS
S3 - 2 POLE
METER (+)
RCVR INPUT (NOT IN CABLE)
VERT OUTPUT (NOT IN CABLE)
S2 (FRONT)
S1 (FRONT)
TOP VIEW
* LOCATION OF SHUNT CAPACITORS USED TO ADJUST C12 AND C13 TO DESIRED VALUES
L1 3255-0001
L2 3255-0000
L3 3255-0002
BOUND TECHNOLOGY
CIRCUIT LAYOUTS
MODEL 1000A
4/75

A THREE TIMES FASTER AND EASIER WAY TO ALIGN FM RECEIVERS

Here's a technique that lets you measure receiver rf and audio quality on a scope -- no meters needed. And you don't even need to remove the receiver cabinet.

If you look upon the task of aligning f-m mono and stereo receivers as an exercise in frustration, then read on. Because we'll tell you about a quick technique and a new type of alignment generator that lets you do the job in just minutes. Not only that, but this technique lets you know for sure when you've achieved best alignment -- you don't have to tune in a station and do some final tweaking to make the receiver "sound right."

And there are some other things you can do with the technique that you'll like.

Let's first look at how simple and fast it is to check receiver alignment and audio quality (the technique does both). To start with, you merely connect the new generator, the receiver or tuner, and a scope as shown in Fig. 3. It's worth noting that you don't have to remove the receiver cabinet or go inside the receiver at all to check alignment or measure audio quality. The generator connects to the antenna terminals, and the scope connects to the receiver audio output through the generator.

When things are turned on and the receiver and generator tuned to the same rf frequency, you'll get a scope pattern like that in Fig. 1(a). What's of main interest in this scope pattern is the shape of the envelope. Why? Well, this particular generator is different from any other you've used. It sweeps a constant-deviation small f-m signal of some 10 kHz back and forth across the receiver bandwidth. At the output of the discriminator this same small f-m signal, now detected, will be superimposed on the familiar receiver S-curve shown in Fig. 1(b). The detected small 10 kHz signal can be seen in Fig. 1(b) as a ripple. Now if the S-curve of the receiver is exactly linear over its useful range, the detected 10 kHz signal will have a constant amplitude. But if the S-curve is not linear, the amplitude of the 10 kHz signal at the discriminator output will vary with position on the S-curve.

To enable us to look at the amplitude of the 10 kHz signal more clearly, the audio output of the receiver, which resembles Fig. 1(b), is connected to the generator (Fig. 3). There the small 10 kHz signal is separated from the low-frequency sweeping signal, amplified, and fed to the scope for vertical deflection. The vertical amplitude is thus proportional to the slope of the S-curve, i.e., to the small-signal gain of the receiver. The envelope you see in Fig. 1(a) is therefore a plot of the small-signal gain versus carrier frequency.

As you well know, if the S-curve is not linear, distortion will be produced in the receiver's demodulated signal. So sometimes alignments are done by just looking at the S-curve on a scope, but this gives only a gross result. That's why the discriminator has preferably (until now) been adjusted while watching a distortion meter connected to the audio output of the receiver. This, though, is a slow process, requires costly equipment and doesn't always give the best alignment.

In the new method the envelope tells you in numbers how good the distortion is, and it tells you how well the entire receiver is aligned. Also, the distortion measurement takes into account the entire bandwidth of the receiver and you can see exactly how distortion is increasing at the band edges. [The pattern shown in Fig. 1(a) is actually a visual presentation of intermodulation distortion -- the amplitude modulation of a small-amplitude high-frequency signal (10 kHz in this case) by a large-amplitude low-frequency signal (our sweep signal). The change in pattern height over a particular portion of the band gives the peak intermodulation distortion over that band portion. This is a very sensitive method of measuring distortion and the results are not confused, as they would be in the case of a measurement of total harmonic distortion, by the de-emphasis in the receiver which attenuates harmonics above about 2 kHz.]

In addition to these advantages the technique is fast. That's because it's a sweep method and you can see what you're doing. At the same time, again because it is a sweep method, it shows you the familiar i-f and discriminator sweep patterns (S-curve) whenever you wish (Fig 1(b, c)).

THE FAST WAY TO MEASURE DISTORTION

If the receiver S-curve were perfectly linear, the envelope (see Fig. 4) would have a completely flat plateau across the top. But the fact that unevenness is present in the plateau is the result of non-linearity in the S-curve. The amount of distortion caused by this non-linearity is the ratio of the p-p amplitude of this unevenness (ripple) to the p-p amplitude of the whole envelope. As indicated in Fig. 4(b), the ripple is measured over a 150 kHz portion of the center of the bandwidth. This 150 kHz portion corresponds to 100% modulation.

To more readily measure the ripple in Fig. 4(a), we increased scope sensitivity by 5x which magnifies the plateau as in Fig. 4(b). Now the ripple is about 0.6 cm p-p which in this particular case corresponds to .06 volt p-p (0.1 v/cm scope setting). The middle portion of the pattern in Fig. 4(a) is 6 cm high p-p which translates to 3 v p-p (0.5 v/cm scope setting). So the distortion is .06/3 or .02, i.e., 2%. Simple, no?

Please note, too, that what you are measuring is peak intermodulation distortion (IMD) and not rms or average intermodulation distortion. This latter distinction is important because IMD is a more sensitive indicator of distortion than total harmonic distortion (THD) and this is even more true for the case of peak IMD.

Incidentally, you can approximately convert a peak IMD measurement to a THD measurement by dividing the peak IMD value by 5. This assumes that the harmonic measurement is made on a signal low enough in frequency that the important harmonics in the THD measurement are not attenuated by the receiver's de-emphasis of high audio frequencies. If the important harmonics are so attenuated, the THD measurement will be incorrect (too low).

Just to prove the case between peak IMD and THD results, we measured the THD in the audio of the receiver that produced Fig. 4(a, b) with the very best laboratory equipment. We obtained a THD value of 0.37% (2% peak IMD divided by 5 would give us an equivalent THD of 0.4% so the correlation is certainly close). Thus you can see that the measurement is meaningful, to say the least.

READING RECEIVER BANDWIDTH

You can read receiver bandwidth directly from the scope pattern of Fig. 1(a) and 4. That's because the horizontal scale is linear and the deviation meter on the alignment generator is calibrated (accurately) to show the peak-to-peak sweep width, which you adjust with a panel control. For example, the sweep width in Fig. 4 is 500 kHz p-p (50 kHz/cm). The receiver is normally tuned to the center of this pattern and the signal you see in Fig. 4 is swung 250 kHz on either side of center.

RECEIVER ALIGNMENT

The alignment method we've described allows you to quickly align a receiver for what the designers call optimum linear bandwidth. A wide linear bandwidth is essential to prevent distortion on f-m modulation peaks, and it is extra important for stereo because the stereo sidebands are widely separated from the carrier -- much more so than for mono.

In aligning with this method you should strive for an envelope that is symmetrical and that has smooth rounded edges with a flat central plateau. If the plateau is not flat, the receiver will distort the audio. If the pattern has appreciable humps or abrupt drop-offs at the edges, the receiver will be difficult to tune.

OTHER PATTERNS

There's so much this new procedure can tell you, not just about the discriminator alignment but also about the i-f and even about the audio performance, that it's difficult to keep from showing you more pictures. So here are two more scope patterns you will find interesting.

First, Fig. 5. This pattern is found on occasion when a discriminator is aligned using an f-m broadcast station or a conventional signal generator as the signal source. Here, the discriminator is producing two plateaus. When the receiver is tuned to the right-hand plateau, the audio sounds pretty good because the plateau is fairly flat.

But notice, too, that the station can be received at two adjacent places on the dial since there are two plateaus. And each of the two will be rather hard to tune in because of the narrowness of the plateau. (Ever had this happen to you when tuning a set?)

The narrow plateaus in Fig. 5, although they can accommodate 100% modulation (75 kHz peak deviation), will result in excessive distortion on modulation peaks since these frequently exceed 100% modulation. Fig. 6 is a scope photo of the audio from the discriminator of Fig. 5. At the top of the audio peak there is noise (not too visible in the photo but you can see slight wiggles). At the troughs of the audio there is severe clipping where the discriminator output fell abruptly.

INCREASES SHOP PROFIT

The method we've been describing is already in use in a number of factories and service shops throughout the country. It is even being used in clinics to show customers how well their receivers perform. There, a big advantage is that it is not necessary to remove the cover to see the highly informative sweep alignment

pattern. When it comes to actual alignment, the method is fast because it lets you see what you're doing, as with any sweep method, and it provides a simple, direct view of distortion and tuning characteristics.

The service manager of a leading West Coast hi-fi sales and service organization estimates this method has cut the time required to align a 'known' receiver to one-third of that previously required, to say nothing of the improved quality of the work. Another shop owner feels that this method lets him now include an alignment with each repair job at little additional cost, thereby generating additional business.

Time is saved for the shop because the generator has incorporated in it a precision stereo and monaural modulation capability. Separate controls are used for the sweep function, so very little time is lost when switching between the sweep function and mono or stereo. A separate control and test pushbutton let you quickly set pilot level with all other modulation removed.

THE GENERATOR

The new alignment generator, the Sound Technology Model 1000A, (Fig. 2) that includes this special sweep has many other qualities that make it a beauty. First, it is basically a small, high-quality f-m transmitter that has an exceedingly pure signal -- total harmonic distortion at the r-f output at 100% modulation is rated as less than 0.1% mono or 0.2% stereo. To get this signal purity, the generator has a specially-developed linear modulator.

And the 1000A includes all the other requirements necessary to test stereo equipment including L, R, L+R, and L - R signals and a digital stereo system that gives in excess of 50 dB separation. It also has an internal 67 kHz modulation source for aligning SCA traps. Modulation of the generator with full SCA program material while simultaneously modulating with stereo or mono signals can be done by using an auxiliary wide band input on the rear panel (Option M1).

The unit is also capable of all conventional sweep alignment functions.

One extra-important feature is the precision piston output attenuator that lets you make a fast check of receiver alignment at various r-f levels. Some receivers will change alignment with r-f level and this attenuator lets you check at levels from 0.5 microvolt to 30,000 microvolts with one continuous turn of the knob.

All in all, the Model 1000A, in addition to its new features, is such as to make it a laboratory instrument as well as one that will certainly make its mark in the service field. The experienced stereo man can infer the quality of some of its signals by looking at Figs. 7 and 8.

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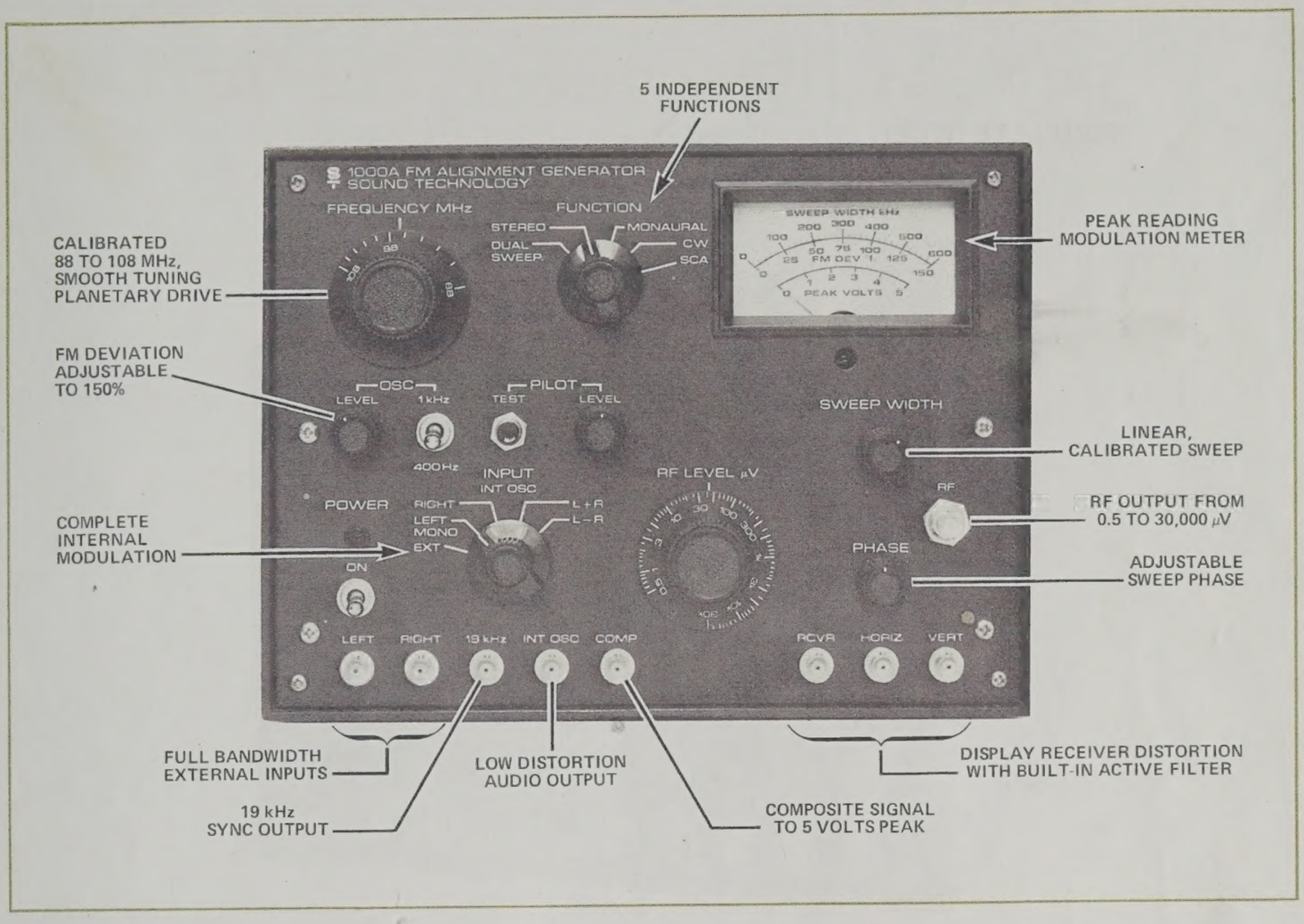


Features

- ★ Unique DUAL SWEEP function with a wide-band linear modulator and a built-in active filter lets you see at a glance the critical parameters, LINEARITY, BANDWIDTH, and TUNING SYMMETRY — without probing inside the receiver.
- ★ Conventional sweep alignment capability.
- ★ Linear, calibrated sweep permits direct determination of receiver bandwidth and tuning symmetry.
- ★ RF tuneable from 88 to 108 MHz. Modulation sensitivity held constant across the band.
- ★ Piston attenuator calibrated from 0.5 to 30,000 µV permits a quick look at receiver alignment vs RF level.
- ★ Precision stereo modulator utilizes crystal controlled digital circuits for precise phase relationships. Overall separation better than 50 dB at 1 kHz.
- ★ Low distortion MONAURAL function for over-all receiver distortion measurements.
- ★ CW function provides a signal with very low incidental FM for receiver quieting (signal-to-noise ratio) tests.
- ★ Internal SCA modulation for receiver SCA trap adjustments.
- ★ Sweep width, monaural and stereo modulation, pilot level (X10 scale on PILOT TEST), and composite output monitored on peak reading meter.
- ★ Metered COMPOSITE output for separate alignment and testing of stereo decoders.
- ★ Optional wideband modulation input.
- ★ Optional front panel switch selects 400 Hz or 1 kHz as internal oscillator frequency.

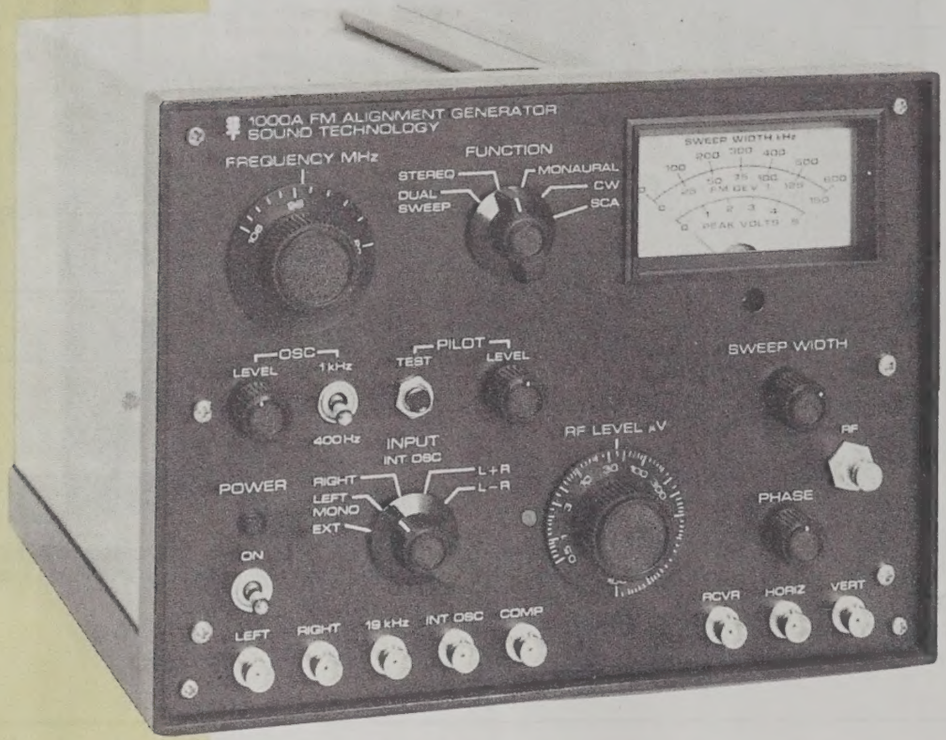
Applications

- ★ Development of stereo FM systems.
- ★ Rapid, accurate production alignment of stereo equipment.
- ★ Servicing FM tuners, receivers, and stereo adapters.
- ★ Fast determination of receiver performance without internal connections.
- ★ Manufacturer's final QA of receivers.
- ★ Development of SCA equipment.

MODEL 1000A

FM ALIGNMENT GENERATOR

COMPLETE RECEIVER ALIGNMENT — A MINIATURE LOW DISTORTION FM TRANSMITTER PLUS FAST, ACCURATE DUAL SWEEP ALIGNMENT



Five instruments in one!

1. Dual sweep alignment.
2. Complete stereo generator.
3. Monophonic FM generator.
4. Clean CW signal.
5. SCA modulation.

DESCRIPTION

The all solid-state 1000A FM ALIGNMENT GENERATOR is designed specifically to permit fast, accurate adjustment of monaural and stereo FM systems. DUAL SWEEP, a refinement of conventional sweep alignment techniques, provides a unique visual display of receiver performance. An operator need only connect the 1000A RF output to the receiver antenna terminals and feed the receiver audio output to the 1000A's built-in filter. Distortion and tuning characteristics will then be displayed — even on an inexpensive scope — without probing inside the receiver.

The 1000A offers much more than DUAL SWEEP capability. With a highly linear modulator, it produces complete, high quality, monaural and stereo signals exceeding FCC specs. An internal RF oscillator is tuneable across the fm band and provides an output continuously adjustable in level from 0.5 to 30,000 μv.

SOUND TECHNOLOGY

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